UNITED STATES

National Science Foundation

FY 2019

Agency Financial Report

THE NSF STATUTORY MISSION

To promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense; and for other purposes.

—from The National Science Foundation Act of 1950 (P.L. 81-507)

THE NSF VISION

A Nation that is the global leader in research and innovation.

—from "Building the Future: Investing in Discovery and Innovation"
NSF Strategic Plan for FY 2018-2022

ABOUT THIS REPORT

For fiscal year (FY) 2019, the National Science Foundation (NSF) issues three reports to provide financial management and program performance information to demonstrate accountability to our stakeholders and the American public. These reports are produced in accordance with the Office of Management and Budget (OMB) Circular A-136, *Financial Reporting Requirements,* and meet the requirements of the Chief Financial Officers (CFO) Act, as amended by the Government Management Reform Act of 1994, the Federal Managers' Financial Integrity Act of 1982, the Reports Consolidation Act of 2000, and the Government Performance and Results Modernization Act of 2010.

- The ***Agency Financial Report*** (AFR) focuses on financial management and accountability. Below is a high-level summary of the AFR's three chapters:
  - *Chapter 1: Management's Discussion & Analysis* provides a high-level overview of NSF's organizational structure, strategic framework, programmatic and financial performance, and management assurances related to NSF's internal controls.
  - *Chapter 2: Financials* includes the results of NSF's annual financial statement audit and financial statements and accompanying documents.
  - *Chapter 3: Appendices & Other Information* contains the memorandum from the NSF Inspector General (IG) on the agency's FY 2020 management challenges, NSF management's report on the progress made on the challenges identified by the IG for FY 2019, information on improper payments, patents and inventions resulting from NSF support, and other relevant information.
- The ***Annual Performance Report*** (APR) provides information on the progress NSF has made toward achieving its goals and objectives as described in the agency's strategic plan and Annual Performance Plan, including the strategic objectives, performance goals, and Agency Priority Goals. The ***APR*** will be included in NSF's *FY 2021 Budget Request to Congress* in February 2020.
- NSF's ***Performance and Financial Highlights*** report summarizes key financial and performance information from the *AFR* and *APR*. This will be available on NSF's website when the *FY 2021 Budget Request to Congress* is published in February 2020.

All three reports are available on NSF's website as they are completed.[1] For copies of these reports, please send a request to accountability@nsf.gov or call (703) 292-8200. We welcome your suggestions on how we can make these reports more informative.

NSF by the Numbers	
$8.1 billion	FY 2019 Appropriations (does not include mandatory accounts)
1,800	Colleges, universities, and other institutions receiving NSF funding in FY 2019
41,000	Proposals evaluated in FY 2019 through a competitive merit review process
11,300	Competitive awards funded in FY 2019
192,000	Proposal reviews conducted in FY 2019
303,000	Estimated number of people NSF supported directly in FY 2019 (researchers, postdoctoral fellows, trainees, teachers, and students)[2]
60,000	Students supported by NSF Graduate Research Fellowships since 1952

[1] Online resource for NSF's accountability reports: https://www.nsf.gov/about/performance/
[2] Preliminary data to be updated in December 2019 and reflected in the FY 2021 Budget Request to Congress: https://www.nsf.gov/about/performance/

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A MESSAGE FROM THE DIRECTOR

Photo: NSF/Stephen Voss

The National Science Foundation (NSF) is pleased to present its *Fiscal Year (FY) 2019 Agency Financial Report*. In addition to providing the annual financial performance and accountability results, this report highlights NSF's accomplishments this fiscal year as we pursue our mission to "promote the progress of science, to advance the national health, prosperity and welfare; and to secure the national defense..."

For almost seven decades, NSF has invested in discovery and education that has sparked new ways of thinking about scientific, economic, and sociotechnical challenges facing the Nation and the world. Among the exciting and transformational results we witnessed in 2019 was the first-ever image of a black hole some 55 million light-years away, captured by the NSF-supported Event Horizon Telescope. Also, this year, the agency invested strategically to accelerate research and spur innovation in quantum technology. NSF-supported research will advance quantum information science and engineering, taking it from theory to practice, in order to lay the foundations for a new century of discovery in the quantum realm. As the Nation's leader in polar policy, research and logistics, NSF is charting a new course in the once remote, yet still challenging Arctic. In 2019, NSF joined an international coalition to study Arctic changes by supporting the MOSAiC (Multidisciplinary drifting Observatory for the Study of Arctic Climate) project.

These accomplishments all reflect NSF's commitment to partnerships that reach academia, government and industry, both domestic and international. I am proud of NSF's long history of partnerships that leverage federal resources to advance science and engineering research, education, and training—often accelerating innovation and strengthening outcomes. One prominent example from this year has been the update to the National Artificial Intelligence (AI) Research and Development Strategic Plan, which was released in September. Because of the inherently cross-disciplinary nature of the field, AI research relies on partnerships and collaborations. The flow of people, ideas, and innovations across government, academia, and industry not only enhances domestic economic benefit, but also positions the country as a global leader. In tandem with these partnerships, we are also seeing the power of convergence—the integration of scientific disciplines to foster the robust collaborations needed to address complex problems. The NSF Convergence Accelerator, one of NSF's Big Ideas, pursues a singular vision: identify areas of research where investment in convergent approaches (those bringing together people from across disciplines, united to solve problems) has the potential to translate research into high-value results and advance ideas from concepts to deliverables. In FY 2019, the first set of awards made through the Convergence Accelerator will leverage multidisciplinary research to find new ways to apply Big Data to science and engineering and create technologies that can enhance the lives of American workers.

NSF investments support and enable science & engineering talent. In FY 2019, the agency directly supported approximately 303,000 researchers, graduate and undergraduate students, postdoctoral fellows, trainees, as well as K-12 teachers and students. Collectively, NSF-funded researchers have won 242 Nobel Prizes in physics, chemistry, physiology and medicine, and economics, including six Nobel laureates in 2019. In addition, among the 2019 MacArthur Fellows, five were supported by NSF funding at some point in their careers.

NSF strives to ensure that students from all sectors of our society have access to exemplary learning experiences. Our education and training portfolio funds programs that enrich educational experiences for all students and enhance science, technology, engineering, and mathematics (STEM) talent needed for the 21st

century. Students must be prepared for a world increasingly dependent on technology, and educators are developing learning platforms and training programs to pique scientific curiosity and strengthen analytical skills. This year, NSF enhanced its support for the re-entry of women, particularly women veterans, to the STEM workforce through NSF INCLUDES. NSF also seeks to support the aspirations of girls and women who are inspired to careers in science and education through programs like ADVANCE: Organizational Change for Gender Equity in STEM Academic Professions, the national PBS multimedia project "SciGirls," and Broadening Participation in Computing. These opportunities challenge students to exceed expectations, help guide future career choices, and foster an inclusive environment of scientific exploration that is welcoming to all.

With the publication of the FY 2019 Agency Financial Report, I am pleased to report that NSF received its 22nd consecutive unmodified opinion from an independent audit of its financial statements. The Independent Auditors' Report identified no material weaknesses or significant deficiencies. In addition, NSF provides reasonable assurance that the agency is in compliance with the Federal Managers' Financial Integrity Act, and that internal control over financial reporting is operating effectively to produce reliable financial reporting.

For more information on NSF's performance management process and the complete results of our FY 2019 annual goals under the Government Performance and Results (GPRA) Modernization Act of 2010, I invite you to read NSF's Annual Performance Report, which will be released with NSF's FY 2021 Budget Request to Congress. In keeping with government-wide requirements, NSF's GPRA data are subject to rigorous verification and validation by an independent, external management consultant, based on guidance from the U.S. Government Accountability Office.

It is NSF's commitment to efficient and effective management practices and sound financial oversight that allows NSF to pursue critical investments in science and engineering research and education. The discoveries and advances of this past year remind us of how NSF's investments take us beyond what we previously imagined. NSF carries our Nation forward, and it provides the ideas and the inspiration needed to keep us at the frontiers of learning, discovery, and innovation.

/s/
France A. Córdova

November 14, 2019

Chapter 1

Management's Discussion and Analysis

AGENCY OVERVIEW

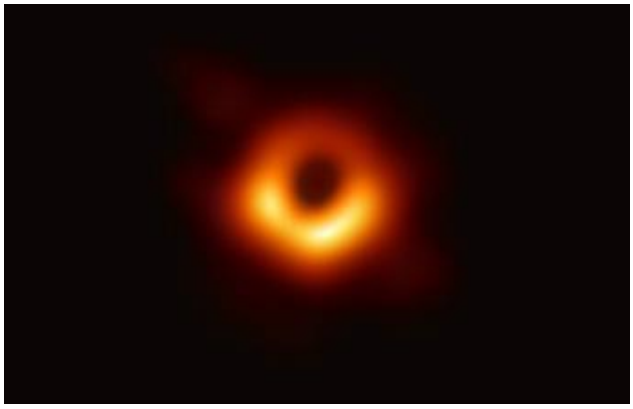
Mission and Vision

The National Science Foundation (NSF) was established in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense…"[1] It is the only federal agency that supports fundamental research in all fields of science and engineering. NSF also helps researchers and small businesses develop their discoveries into products and services through technology development, entrepreneurship training, and industrial partnerships.

Throughout its 69 years, NSF has supported research and people that explore the unknown and advance the frontiers of science and engineering. Situated at the intersection of all science and engineering disciplines, NSF is uniquely positioned to identify and guide investments toward new, cutting-edge research areas. NSF funds researchers who generate new knowledge and discoveries that provide a greater understanding of the world around us. These discoveries have led to many transformative breakthroughs such as, the first image of a black hole, detection of gravitational waves, kidney exchanges that match recipients to compatible donors, 3D printing, auctions for telecommunications spectrum allocations, the early web browsers, advanced wireless communications, and magnetic resonance imaging technology.

Astronomers capture first image of a black hole

The Event Horizon Telescope (EHT) was designed to see the unseeable. Black holes exert such strong gravitational forces that even light can't escape them. It took EHT, a planet-scale array of eight ground-based radio telescopes linked through international collaboration, to gather the first direct visual evidence of a supermassive black hole and its shadow, 55 million light-years from Earth. EHT uses a technique called very-long-baseline interferometry (VLBI), which synchronizes telescope facilities around the world to form one huge, Earth-size telescope. Decades of NSF investments in VLBI and radio astronomy technologies led to the creation of EHT and the black-hole image. In 2019, EHT's members were awarded the Breakthrough Prize in Fundamental Physics, an annual recognition in scientific achievements. Their next goals include imaging the supermassive black hole at the center of the Milky Way and capturing video of a black hole.



Using the EHT, scientists obtained an image of the black hole at the center of galaxy M87, outlined by emission from hot gas swirling around it under the influence of strong gravity near its event horizon. *Credit: Event Horizon Telescope Collaboration et al.*

To advance NSF's mission and keep the Nation at the forefront of research, technology, and innovation, NSF is executing a bold research agenda of Big Ideas[2] that define cutting-edge research goals uniquely suited to NSF's capabilities and implement new processes to catalyze advances in research by embracing new practitioners and new approaches. In fiscal year (FY) 2019, for example, NSF opened new avenues for research with the Convergence Accelerator (CA). Awarded to teams with partners from academia, industry, and government, CA awards foster communities that will work to enable capabilities far beyond what is currently possible in either the private or public sectors.

[1] National Science Foundation Act of 1950 (P.L. 81–507)

[2] NSF's 10 Big Ideas: https://www.nsf.gov/news/special_reports/big_ideas

Also, in FY 2019, NSF funded a new suite of activities collectively known as the Quantum Leap Big Idea. Quantum Leap is bringing together researchers from many different fields to address the fundamental science and engineering questions underlying all areas of quantum science and its applications.[3]

An entire year trapped in the ice

In most cases, having your vessel frozen to an iceberg in the Arctic would be a worst-case scenario. For a group of international researchers who set sail in 2019, it was the launchpad for the largest polar expedition in the world. Hundreds of researchers, including NSF-supported scientists from the U.S., boarded the German research vessel (RV) Polarstern for the MOSAiC (Multidisciplinary drifting Observatory for the Study of Arctic Climate) expedition, a year-long operation that required lengthy logistical preparation by NSF staff and their international partners. Researchers worked to set up an observational network monitoring air, land, and sea that stretched over the sea ice as far as 30 miles away from the research vessel. MOSAiC aims to produce breakthroughs in understanding the Arctic climate system.

The German RV Polarstern, which is serving as the base for the MOSAiC expedition, during an Arctic expedition. *Credit: Mario Hoppmann*

In FY 2019, the agency continued investing in fundamental research and innovative approaches that predict the trajectory and intensity of natural hazards and help ensure that the Nation's infrastructure will be more resilient to earthquakes, hurricanes, and other forces of nature. NSF-funded investigators conducted research to improve people's lives with smart transportation, advanced materials, and advanced manufacturing. NSF also continued to support Artificial Intelligence (AI), a highly interdisciplinary endeavor that draws on fields such as computer and information science and engineering, cognitive science and psychology, economics and game theory, engineering and control theory, ethics, linguistics, mathematics and statistics, and philosophy. Indeed, NSF's investments in AI over the last several decades have laid the foundation for today's breakthroughs. Other NSF-funded researchers improved cryptography and cybersecurity and helped support the U.S. military by developing lighter, more flexible bulletproof vests, next-generation prosthetics, new methods for treating post-traumatic stress disorder, and advanced analytics for massive datasets that support the national defense. NSF-supported nano-oriented centers and networks across the country have led to discoveries of the fundamental mechanisms driving activity at extremely tiny dimensions. As a major player in nanotechnology, NSF is helping to transform U.S. industry through advances in manufacturing, electronics, medical instrumentation, and materials science. Nanotechnology research leads to advances in drug development, computing and communications, imaging, and wearable technologies.

In FY 2019, NSF continued investments in research facilities and centers that foster collaboration and provide sophisticated platforms for conducting cutting-edge research. NSF supports world-class research infrastructure including ships, planes and autonomous research platforms, ground-based telescopes, the world's largest and highest-powered magnet lab, long-term ecological sites, engineering centers, and other infrastructure and state-of-the-art tools to sustain the Nation's scientific enterprise. NSF also

[3] Leading the Quantum Revolution: https://www.nsf.gov/news/factsheets/Quantum_Factsheet_v2_D.pdf

supports research stations in the Arctic and Antarctic. In April 2019, the EHT (see inset on MD&A-1) unveiled the first-ever image of a black hole. NSF played a pivotal role in this discovery by funding individual investigators, interdisciplinary scientific teams, and radio astronomy research facilities since the inception of EHT. In September 2019, NSF launched Frontera, the fastest supercomputer at any university, which is providing scientists across the country with access to unprecedented computational modeling, simulation, and data analytics capabilities to ensure that the U.S. retains its global leadership in research frontiers. These kinds of breakthroughs are possible because of the Foundation's long-term commitment to basic research and steady advancements and upgrades to research facilities.

NSF helps researchers and small businesses translate scientific innovations and knowledge into commercial products and services through programs like the Small Business Innovation Research program and NSF Innovation Corps. The Foundation also supports programs to spur academia-industry partnerships to create enabling technologies that meet national needs, such as helping to transform modern manufacturing and contributing to advanced medical imaging.

NSF's sustained investment in basic research results in a steady stream of new ideas and techniques that, together with a well-educated science, technology, engineering, and mathematics (STEM) workforce, foster a world-class research enterprise. NSF programs support STEM education and training that attract individuals from every sector and group in society, ensuring a pipeline of diverse people and ideas ready to solve pressing global challenges in STEM. NSF's Advanced Technological Education program focuses on the education of technicians for the high-technology fields that drive our Nation's economy. NSF also supports a strong STEM workforce through the Graduate Research Fellowship Program (GRFP). Since 1952, NSF has funded over 60,000 Graduate Research Fellows. Many of these Fellows have gone on to become leaders in their chosen fields and have made groundbreaking and important discoveries in STEM research. Over 450 Graduate Research Fellows have become members of the National Academies of Sciences, Engineering, and Mathematics; and 40 Fellows have been honored as Nobel laureates. Additionally, NSF has funded the research of 242 individuals who have gone on to win the Nobel Prize. These investments in people are a critical means by which NSF achieves its mission.

Frontera: Fastest academic supercomputer in the world

Scientific challenges increasingly demand more computing power. The U.S. science and engineering community gained a major resource in 2019 when the Texas Advanced Computing Center (TACC) launched Frontera, the most powerful supercomputer on any academic campus and the fifth fastest system in the world. Supported by NSF, Frontera serves as a tool that will enable discoveries by researchers from across the country. Within weeks of coming online, the system had already enabled research in areas ranging from black hole physics to drug design, leveraging data analytics and artificial intelligence capabilities. It has already performed simulations of neutron stars merging and helped train neural networks to predict the characteristics of new drug compounds. Frontera is expected to have a major effect on fields including natural hazards modeling, genomics, astrophysics, and materials sciences.

Frontera is the most powerful supercomputer on any academic campus and the fifth fastest system in the world. *Credit: TACC*

NSF's vision is to ensure that the U.S. remains the global leader in research and innovation. NSF's core values of excellence, public service, learning, inclusion, collaboration, integrity, and transparency articulate the essential qualities that staff are encouraged to embody in support of the agency's mission and vision. These core values guide staff in making decisions, setting priorities, addressing challenges, managing tradeoffs, recruiting and developing personnel, and working together with awardee recipients. NSF's strategic plan for FY 2018 – 2022, *Building the Future: Investing in Discovery and Innovation*,[4] identifies three interrelated goals for achieving the agency's mission: (1) expand knowledge in science, engineering, and learning; (2) advance the capability of the Nation to meet current and future challenges; and (3) enhance NSF's performance of its mission.

Placement of wind turbines is key

Nearly 90 percent of wind farms in the U.S. are located within 40 kilometers of another wind farm. NSF-funded researchers used data and analytic tools from across the fields of atmospheric science, economics, and law to model the consequences of upwind turbine wake effects on downwind turbine energy production and revenues. The researchers also explored the legal constructs guiding wind farm construction. The study found that wake effects from upwind turbines can cover large distances (over 50 kilometers), decreasing the energy production by downwind turbines and causing economic losses of millions of dollars. While many states and the federal government have put policies in place to guide the creation of wind farms, there is little legal guidance to help protect wind farms from the wake-effects of other farms.

Wakes from windmills are larger and extend for far larger distances than was previously understood. *Credit: ©University Corporation for Atmospheric Research*

Public investment in high-risk, foundational research is key to staying on the cutting edge of science and technology. NSF supports 25 percent of all federally sponsored basic scientific research conducted by America's colleges and universities; this share increases to 60 percent when medical research supported by the National Institutes of Health is excluded.[5] Basic research funded by NSF has created many of the critical industries, tools, and products that drive life in the 21st century. NSF investment in research that enables discovery represents the fulfillment of the Foundation's mission and its commitment to advancing the frontiers of science and engineering. This commitment ensures sustained vigor of fundamental research and positions the U.S. for economic growth and continued prosperity.

NSF by the Numbers

NSF is funded primarily through congressional appropriations that are provided to six accounts: Research and Related Activities (R&RA), Education and Human Resources (EHR), Major Research Equipment and Facilities Construction (MREFC), Agency Operations and Award Management (AOAM), the National Science Board (NSB), and the Office of Inspector General (OIG). Appropriations in these six accounts in FY 2019 totaled $8,075 million,[6] an

[4] NSF Strategic Plan FY 2018 – 2022: https://www.nsf.gov/pubs/2018/nsf18045/nsf18045.pdf

[5] National Center for Science and Engineering Statistics Survey of Federal Funds for Research and Development Fiscal Years 2017–2018: https://ncsesdata.nsf.gov/fedfunds/2017/

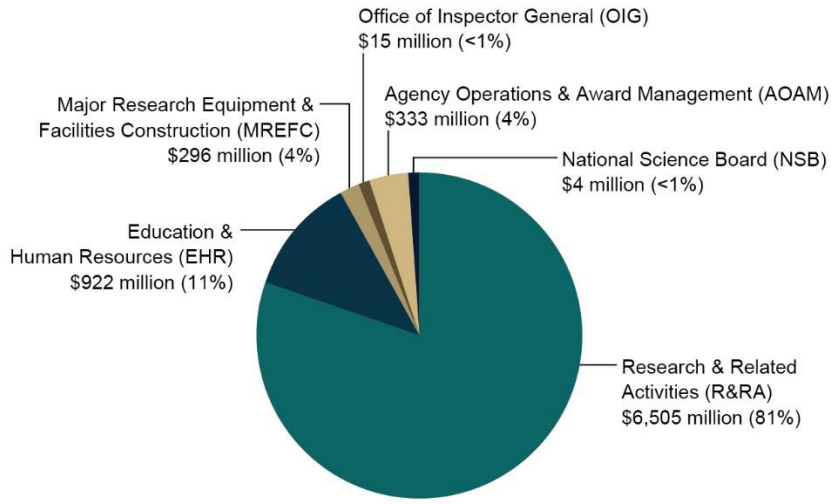
[6] Amount shown is NSF's FY 2019 discretionary appropriations. This amount does not include Donations and H-1B Nonimmigrant Petitioner Receipts. These amounts are included in NSF's appropriations shown in the Statement of Budgetary Resources (SBR). The SBR is on page Financials-17 of this *Agency Financial Report (AFR)*.

increase of approximately 4 percent over the FY 2018 appropriations level of $7,784 million. R&RA, EHR, and MREFC appropriations fund the agency's programmatic activities and accounted for over 95 percent of NSF's total appropriations in FY 2019. Figure 1.1 provides details on NSF's FY 2019 appropriations.

Figure 1.1

NSF Budget Structure

FY 2019 Appropriations by Account—$8,075 million



Note: $15.49 million was transferred from R&RA to EHR and AOAM, $12.0 million and $3.49 million, respectively.
Totals may not add due to rounding.

- R&RA supports basic research and education activities in science and engineering, including high-risk and transformative research. This appropriation accounted for 81 percent of FY 2019 funding. The FY 2019 R&RA funding level of $6,505 million was $154 million higher than the FY 2018 appropriation of $6,351 million.
- EHR, which supports activities to build a diverse, competitive, and globally engaged U.S. STEM workforce and a scientifically literate citizenry, is NSF's second largest appropriation and is about 11 percent of the agency's budget. EHR's FY 2019 funding level of $922 million was $20 million above the FY 2018 EHR appropriation of $902 million.
- The MREFC appropriation supports the construction of unique national research platforms and major research equipment that enable cutting-edge research. This account was about 4 percent of the agency's total appropriations in FY 2019. The FY 2019 MREFC funding level of $296 million was $113 million above the prior-year appropriation of $183 million.
- FY 2019 AOAM funding of $333 million supported NSF agency operations and award management activities. AOAM was 4 percent of NSF's total FY 2019 appropriations. AOAM increased by nearly $5 million from the FY 2018 level of $329 million.
- Separate appropriations support the activities of the OIG and the NSB; each accounted for less than 1 percent of NSF's total FY 2019 appropriations. The FY 2019 OIG appropriation of $15 million increased $140,000 over the FY 2018 appropriation. The NSB received an appropriation of $4 million in FY 2019, the same as the previous year's funding level.

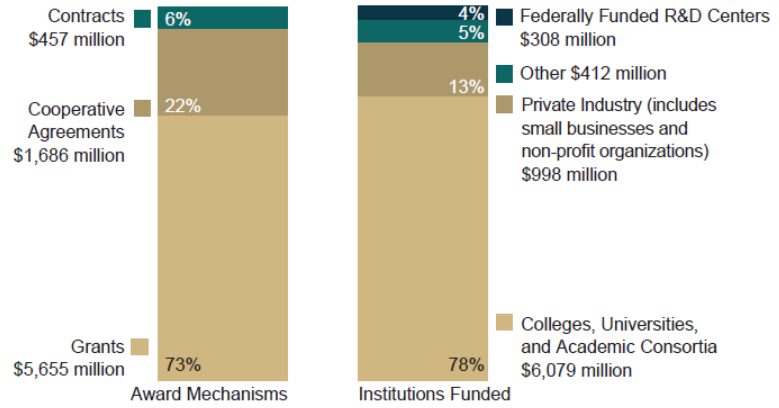
Approximately 29,000 members of the science and engineering community participated in the merit review process as panelists and proposal reviewers.[7] Awards were made to over 1,800 institutions in all 50 states, the District of Columbia, and three U.S. territories. These institutions employ many of America's leading scientists, engineers, and educators; and they train the leading innovators of tomorrow. In FY 2019, about 303,000[8] people were directly involved in NSF-funded programs and activities. Beyond these figures, NSF programs indirectly impact millions of people, reaching K-12 students and teachers, the general public, and researchers through activities including workshops; informal science activities such as museums, television, videos, and journals; outreach efforts; and dissemination of innovative instructional resources and teaching methods.

During FY 2019, NSF evaluated over 41,000 proposals through a competitive merit review process and made approximately 11,300 new competitive awards, mostly to academic institutions. In addition to these proposals, GRFP reviewed approximately 12,000 applications for fellowships. As shown in the Institutions Funded column listed on the right, in Figure 1.2, 78 percent of support for research and education programs ($6,079 million) was to colleges, universities, and academic consortia. Private industry, including small businesses and non-profit organizations, accounted for 13 percent ($998 million), and support to Federally Funded Research and Development Centers accounted for 5 percent, or $412 million. Other recipients (federal, state, and local governments; and international organizations) received 4 percent ($308 million) of support for research and education programs. A small number of awards fund international science and engineering research, education, and partnerships, which add value to the U.S. scientific enterprise and help to maintain U.S. leadership in the global scientific enterprise.

Figure 1.2

NSF Award Mechanisms and Institutions Funded

FY 2019 Obligations for Research and Education Programs ($7,798 million)



Notes: NSF Research and Education programs include - R&RA, EHR, and MREFC appropriations
Other institutions funded include federal, state, and local governments; and international organizations.
R&D = Research and Development.
Totals may not add due to rounding.

As shown in the Award Mechanisms column listed on the left, in Figure 1.2, NSF's award funding is primarily for financial assistance to carry out a public purpose through grants and cooperative agreements. Grants can be funded either as standard awards, in which funding for the full duration of the project is awarded in a single fiscal year, or as continuing awards, in which funding for a multi-year project

[7] For more information about NSF's merit review process, see https://www.nsf.gov/bfa/dias/policy/merit_review/ and the *Report on the National Science Foundation's Merit Review Process, FY 2017* (NSB-2019-15) at https://www.nsf.gov/nsb/publications/2018/nsb201915.pdf

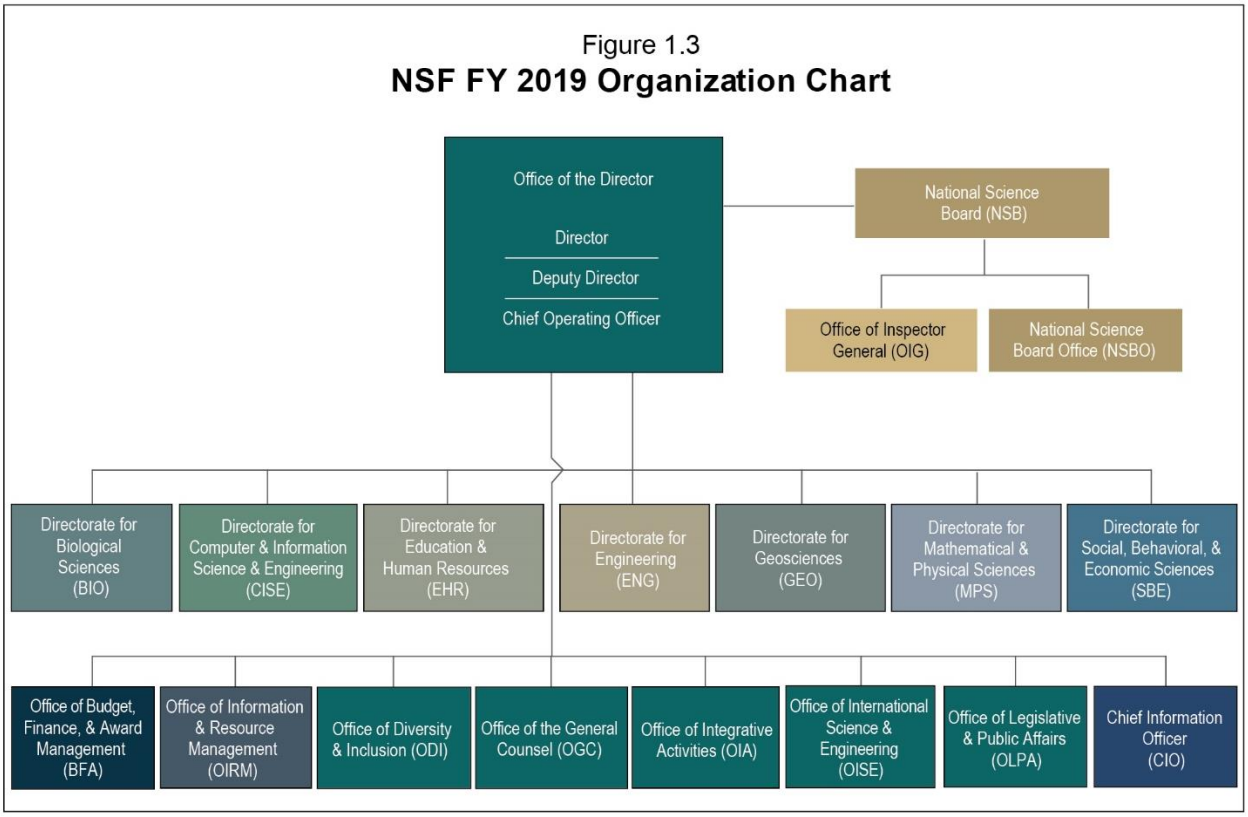
[8] Preliminary data to be updated in December 2019 and reflected in the FY 2021 Budget Request to Congress: https://www.nsf.gov/about/performance/

is awarded in increments. Cooperative agreements are used when the project requires substantial agency involvement during the project performance period (e.g., research centers, multi-use facilities). Contracts (procurement instruments) are used to acquire products, services, and studies (e.g., program evaluations) required for NSF or other government use.

Organizational Structure

NSF is an independent federal agency headed by a Director who is appointed by the President and confirmed by the U.S. Senate.[9] As shown in Figure 1.3, NSF's organizational structure aligns with the major fields of science and engineering.[10]

Figure 1.3
NSF FY 2019 Organization Chart



The NSF Director and the 24-member NSB jointly pursue the goals and functions of NSF, including the duty to "recommend and encourage the pursuit of national policies for the promotion of research and education in science and engineering."[11] The NSB identifies issues critical to NSF's future and helps chart the strategic direction of NSF's budget and programs. The NSB also serves as an independent body of advisors to both the President and the Congress on policy matters related to STEM research and education. NSB members are appointed by the President and are prominent contributors to the STEM research and education community.[12] NSF's Director is a member *ex officio* of the Board. The Director and the other NSB members serve 6-year terms.

[9] The Director's biography: https://www.nsf.gov/news/speeches/cordova/cordova_bio.jsp
[10] NSF's organization chart: https://www.nsf.gov/staff/organizational_chart.pdf
[11] 42 U.S. Code 1862(d): https://www.law.cornell.edu/uscode/text/42/1862
[12] List of NSB members: https://www.nsf.gov/nsb/members

The NSF workforce included 1,415 federal employees in FY 2019.[13] NSF also regularly recruits scientists, engineers, and educators through the Intergovernmental Personnel Act (IPA) who work at NSF for up to 4 years.[14] These "rotators" bring fresh perspectives from across the country and across all fields of science supported by the Foundation, helping explore new directions for research in science, engineering, and education, including emerging interdisciplinary fields. On returning to their home institutions and across academia, rotators bring knowledge of NSF programming and leading research from a national perspective.

In addition to the Foundation's headquarters in Alexandria, Virginia, NSF maintains an office in Christchurch, New Zealand, to support the U.S. Antarctic Program (USAP); and the OIG has an office in Denver, Colorado.

World's largest outdoor shake table

Earthquakes don't just shake the ground horizontally. They heave it vertically and twist it in ways that can tear buildings apart. Now, thanks to a $16.5 million award from NSF, the world's largest outdoor earthquake simulator, located at the University of California (UC) San Diego, does too. The upgrade will enable this "shake table" to more realistically recreate the ground motions of an earthquake. It will allow engineers to test structures from multi-story buildings to bridge columns and wind turbines to find out how resilient they are to earthquake conditions. The enhanced shake table would teach researchers new lessons even if they just repeated the more than 30 tests conducted since 2004. The engineers working on the upgrade already have a plan for the first structure they'll test with it – a 10-story building made from cross-laminated timber.

A graduate student inspects a six-story steel-framed building that is about to be tested on a shake table. *Credit: UC San Diego*

Management Challenges

In October 2018, the OIG identified six areas representing challenges for the agency for FY 2019: (1) managing major multi-user research facilities, (2) meeting the Digital Accountability and Transparency Act of 2014 (DATA Act)[15] reporting requirements, (3) eliminating improper payments, (4) managing the IPA program, (5) managing USAP, and (6) encouraging the ethical conduct of research.[16]

Management's report on the significant activities undertaken in FY 2019 to address the challenges is in *Appendix 2B: Management Challenges—NSF's Response* of this *AFR*. The report also discusses activities planned for FY 2020 and beyond. Some of the agency's significant actions and planned next steps to address the challenges are highlighted below.

Major Multi-user Research Facilities Management

NSF continues its important oversight of recipients' on-going management of major facility awards, as well as its important assessment of prospective recipients'

[13] Full-time equivalents (FTEs) include the federal employee workforce for NSF, the NSB, the OIG, and U.S. Arctic Research Commission

[14] As of September 30, 2019, temporary appointments included 166 under the IPA Mobility Program

[15] DATA Act (P.L. 113-101): https://www.gpo.gov/fdsys/pkg/PLAW-113publ101/pdf/PLAW-113publ101.pdf

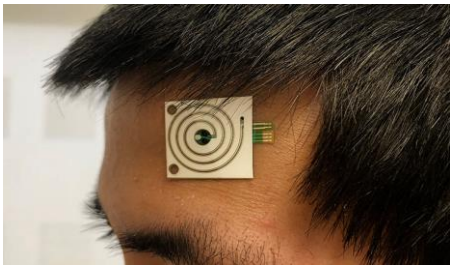
[16] The Inspector General's Memorandum on Management Challenges for NSF in FY 2019 is in NSF's *FY 2018 Agency Financial Report,* Appendix 2A: https://www.nsf.gov/pubs/2019/nsf19002/pdf/08Chap3_Appendices.pdf

capabilities for managing major facilities prior to award. In this regard, the agency has strengthened policies and procedures, including an annual Major Facilities Portfolio risk assessment to determine the necessary reviews and audits to be conducted by NSF's Office of Budget, Finance and Award Management (BFA). Importantly, in FY 2019, NSF continued to strengthen the governance structure, established in FY 2018, to help ensure consistent implementation of NSF's expanded controls for major facilities oversight. NSF is in the process of carrying out corrective actions based on recommendations, to which the agency agreed, following two Government Accountability Office (GAO) reviews. The first review (June 2018) recommended that NSF should revise its policies for estimating and reviewing the costs and schedules of major facility projects to better incorporate the best practices in GAO's guides. The second review (March 2019) recommended that NSF conduct a workforce gap analysis for project management competencies, ensure recipients provide lessons learned and best practices to NSF, and establish criteria for recipient project management competencies to be incorporated into NSF's review process. Progress on this Challenge in FY 2019 is evidenced by finalization of the *Selection of Independent Cost Estimate Review*s Standard Operating Guidance (SOG) and the new *Major Facilities Guide (MFG, NSF 19-68)* to incorporate additional guidance on costs, scheduling, and requirements relating to construction. In September 2019, GAO notified NSF that the revised guidance fully meets GAO good practices. Additional FY 2019 actions include: (1) drafted the *Major Facilities Oversight Reviews* SOG to more fully utilize external review panels in addressing elements of cost and schedule; and (2) received the independent third-party report from the NSF Business and Operations Advisory Committee related to cost surveillance, which deemed NSF practices sufficient, and developed an implementation plan to address minor recommendations.

Going forward, NSF plans to continue strengthening its oversight by: (1) initiating a major facilities portfolio workforce gap analysis, (2) revising Major Facilities Cooperative Agreement Supplemental Terms and Conditions (and any major facility contract terms and conditions) to require recipients to participate in NSF's Knowledge Management Program, (3) finalizing the new *Major Facilities Oversight Reviews* SOG, and (4) drafting and releasing for public comment two new MFG sections.

Wearable sensors read your sweat

What if all you had to do to get a diagnosis at the doctor's office was to work up a bit of a sweat? A team of NSF-funded scientists is developing wearable skin sensors that can analyze your sweat to get the same kind of information that currently requires a more invasive procedure, like taking blood. The researchers essentially print sensors onto plastic, which can then be applied to the body. Currently, the scientists are gathering data from their new sensors, so they can learn what sweat composition can tell us about people's health and wellness. By being able to analyze sweat – and knowing what to look for in that analysis – this research has the potential to make the doctor's office a more pleasant experience.



New wearable sensors developed by scientists at UC Berkeley can provide real-time measurements of sweat rate and electrolytes and metabolites in sweat. *Credit: Bizen Maskey, Sunchon National University*

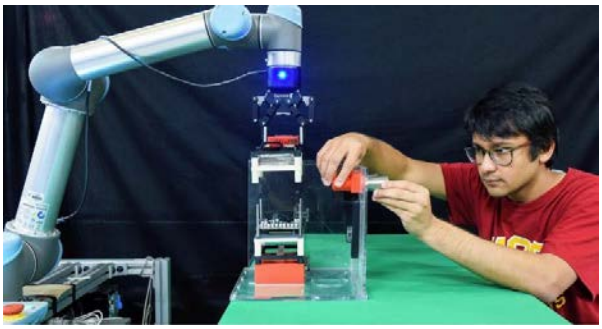
Meeting DATA Act Reporting Requirements

Each quarter, NSF submits all data required by the DATA Act to the U.S. Department of Treasury. Also, in FY 2019, NSF continued to take actions in accordance with the recommendations from the NSF OIG FY 2017 DATA Act audit that were resolved and closed in FY 2018. To continuously improve the accuracy, completeness, and timeliness of NSF data, the agency strengthened its leadership and engagement on government-wide DATA Act-related activities, such as implementing guidance outlined in U.S. Office of Management and Budget (OMB) M-18-16, Appendix A to OMB Circular A-123,

"Management of Reporting and Data Integrity Risk"; serving on the Audit Collaboration Working Group of the Chief Financial Officers Council (CFOC) and Council of the Inspectors General on Integrity and Efficiency; and developing the Data Quality Plan Playbook. As a result of this work, NSF implemented a data quality plan that is based on a government-wide model and conducted a risk assessment demonstrating that it has implemented internal controls to mitigate the risks associated with maintaining and publishing inaccurate spending data. NSF is confident that its risk of reporting inaccurate, incomplete, and untimely data has been mitigated.

Working with industry to strengthen the STEM workforce

Across the U.S., industries are becoming increasingly dependent on technology that is rapidly changing, creating pressure for employers to find workers with STEM skills and knowledge. To empower the workers of today to hold the jobs of tomorrow, a unique public-private partnership will develop online learning platforms – and study the effectiveness of courseware to see what connects with learners of different ages and skill levels. Utilizing a $10 million gift from The Boeing Company, NSF funded five separate projects exploring approaches that will allow schools, companies, nonprofits and others to create new learning experiences to build a stronger, more STEM-educated workforce.



The partnership with Boeing will accelerate training in critical skill areas and increase diversity in STEM fields. *Credit: A. Kabir*

Examples of additional actions taken in FY 2019 to demonstrate progress on this Challenge include: (1) devoting the staff resources to actively participate in the Treasury-led CFOC workgroup on data quality improvements; (2) instituting processes to monitor and independently validate the effectiveness and sustainability of NSF data quality measures by developing and executing a data quality plan that defines NSF's FY 2019 approach to achieve reasonable assurance for internal control over quarterly DATA Act reporting; (3) conducting a risk assessment of 57 essential reporting elements (procurement, financial management, and financial assistance data) and submission processes and reviewed related system controls and Standard Operating Procedures (SOPs); and (4) instituting an ongoing practice of performing an analysis of NSF's submission warnings during the execution phase of the data quality plan.

Going forward, NSF plans to: (1) implement a SharePoint tool to assist in the quarterly DATA Act submission process by tracking Division Director assurances and the SAO certification; (2) continue to work closely with OMB, Treasury, and intragovernmental groups to collaboratively and continuously improve and clarify government-wide standards to achieve transparency and accountability; (3) continue to refine our validation and submission process; and (4) continue stewardship collaboration with NSF OIG and GAO to resolve any recommendations through implementing a corrective action plan.

Eliminating Improper Payments

NSF continues to manage risk related to improper payments effectively. The agency has addressed the OIG's recommendations from the previous OIG reports. As a result, the OIG has determined that NSF was in compliance with the Improper Payment Elimination and Recovery Act (IPERA) risk for the years 2015 through 2018. This validates NSF's strong commitment and top leadership support to incorporate risk management concepts into business processes and management functions, establishing processes to monitor and validate the effectiveness and sustainability of the corrective measures, and incorporating corrective measures into policy and process documentation. Additional examples of actions taken in FY 2019 to demonstrate progress include: (1) conducting advanced and baseline grant monitoring activities including grant payment testing; and (2) operating, evaluating, and reporting on an effective

internal controls program providing assurance that NSF controls over grants and grant payment processes are properly designed and operating effectively.

Going forward, NSF plans to continue activities undertaken in FY 2019 on (1) grant monitoring and payment testing, (2) operating an effective internal controls program, (3) collaborating with the OIG on risk reduction activities; and (4) improving improper payments risk assessment and reporting compliance activities.

Managing the Intergovernmental Personnel Act (IPA) Program

Through the IPA program, scientists, engineers, and educators rotate into NSF as temporary Program Directors, advisors, and leaders to bring fresh perspectives from across the country and across all fields of science and engineering supported by the Foundation. The agency takes a proactive approach in the management of the IPA program to consider and mitigate inherent risks associated with its execution. NSF has established a senior-level IPA Steering Committee that reports directly to the NSF Director and Chief Operating Officer (COO). The Committee ensures that NSF is best utilizing the IPA hiring authority and regularly reports on its oversight and stewardship of the IPA program, including costs associated with the program, to the Director and COO, to OMB, and to Congress. NSF has addressed the relevant OIG-identified management challenges, along with other agency-identified risks and challenges. Through these actions, NSF is confident it has reduced the inherent risk substantially, such that the residual risk is acceptable to the agency. Selected examples of steps NSF took in FY 2019 include: (1) delivering the first IPA Program Annual Report to the Director of NSF, including annual data and trend analyses on various aspects related to the use of IPAs at NSF; (2) developing a corrective action plan to implement GAO's recommendations relating to the agency's use of rotators; (3) monitoring time spent on Independent Research/Development (IR/D) and providing quarterly data to senior managers for appropriate oversight; (4) submitting annual responses on the Justifications for Rotator Pay Exceeding the Senior Executive Service Pay Max to Congress; and (5) extending the IPA cost-share pilot into FY 2019 to continue to evaluate the effectiveness of the 10 percent cost-share requirement.

Breakthrough in predicting dengue fever outbreaks

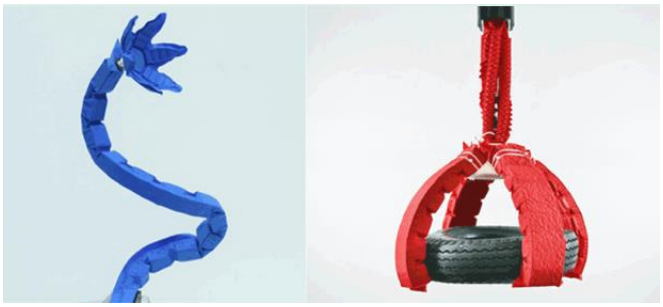
Approximately 100 million people worldwide get sick from dengue and up to 22,000 die from severe cases of this debilitating mosquito-borne disease. Dengue is present in about 100 countries, characterized by explosive outbreaks that can tax health systems. Predicting these outbreaks can mean the difference between life and death for affected populations, which is why researchers have developed a method for forecasting them up to four months in advance. The factors that influence dengue outbreaks, including the strain of virus, number of mosquitos and weather, are so complex they're nearly impossible to measure. Therefore, an NSF-supported international research collaboration found a more practical measurement – by looking at the number of minor dengue infections between past outbreaks, the researchers developed mathematical models to predict future ones. Accurately predicting outbreaks enables public health officials to take steps such as ordering adequate supplies of medicines or safeguarding vulnerable populations.

Scientists have discovered a new way of predicting dengue fever, a mosquito-borne disease. *Credit: J. Gathany*

Going forward, NSF will: (1) continue the various reporting listed above to the NSF Director, NSF senior managers, and Congress; (2) integrate actions associated with the corrective action plan into NSF's ongoing activities to adapt its work and workforce; and (3) continue monitoring established IPA IR/D travel caps.

Management of the U.S. Antarctic Program

NSF funds and manages the USAP and supports United States' research and national policy goals in the Antarctic. While there are inherent risks associated with Antarctica's remote location, extreme environment, and the short period of time during which the continent is accessible, NSF has reduced risk levels to acceptable ranges through leadership commitments, dedication of staff and resources, corrective action planning, and monitoring implementation of plans. Management controls and operating procedures are in place to monitor invoice processing, systems performance, indirect rates, and financial reporting for the USAP contractor. Routine NSF-led meetings are held with Leidos, the Antarctic Support Contractor (ASC), to emphasize prime contractor responsibilities to protect government property and inventory. Among a number of milestones reached in FY 2019, NSF: (1) completed the Antarctic Infrastructure Modernization for Science (AIMS) Final Design Review, the NSB authorized NSF to proceed with AIMS construction, and the project initiated procurement of materials and equipment for transportation to the station; (2) continued to engage the scientific community in efforts to minimize disruption that the AIMS construction process might have on Antarctic science; and (3) updated the 5-year long-range capital plan to include lifecycle and real property investments for all Antarctic locations.



Origami-inspired artificial muscles can lift up to 1,000 times their own weight. *Credit: Shuguang Li, Wyss Institute at Harvard University*

Robots with a softer touch

Soft robotics have the potential to revolutionize the way we live, creating machines robust enough to work in healthcare or manufacturing, yet safe to use around people. But for years, their increased dexterity and flexibility came at a cost: reduced strength. NSF-funded researchers found a way around that, though. Using origami as their inspiration, they have created artificial muscles that allow soft robots to lift objects that are up to 1,000 times their own weight — using only air or water pressure. Each artificial muscle consists of an inner "skeleton" surrounded by air or fluid and sealed inside a "skin." The shape and composition of the skeleton determines the muscle's movement. Adaptable, scalable, and presenting comparably little damage if they break, these soft robots could help humans do everything from gently lifting the injured out of hospital beds to assembling cars.

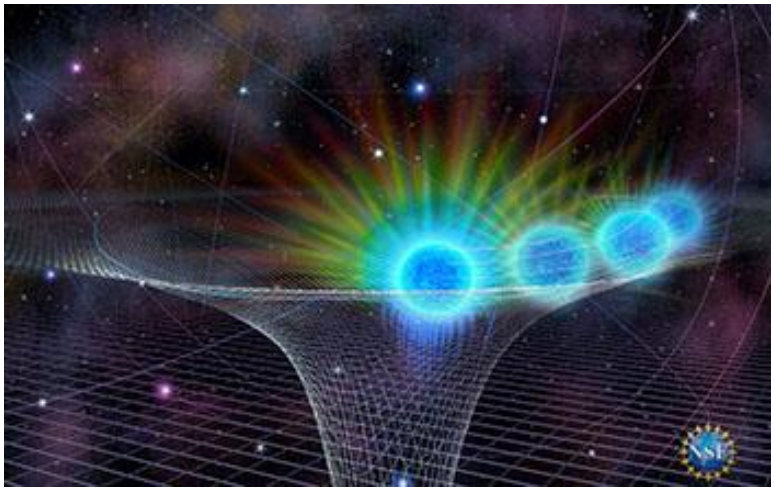
Going forward NSF will continue: (1) fiscal oversight of the ASC and subcontractors; (2) managing inventory by monitoring cargo during the upcoming shipment cycle and conducting weekly NSF-led meetings with the prime contractor on protecting government property; and (3) modernizing facilities in the AIMS project through robust project management to include areas of procurement, logistics, planning, and design and by extending the long-range Antarctic capital plan for lifecycle and real property investments to a 10-year horizon. NSF will continue to stress the importance of the health and safety of researchers and contractors by emphasizing and prioritizing safety matters across the entire program. NSF will additionally continue to implement and update the Code of Conduct, perform a law enforcement site visit at Palmer Station, and monitor implementation of the pharmacy management software system.

Encouraging the Ethical Conduct of Research

The Responsible and Ethical Conduct of Research (RECR) is critical for excellence, as well as public trust, in science and engineering. NSF expressly defines this issue to be inclusive of both the responsible conduct and ethical conduct of research, recognizing a broad conceptualization of this topic. NSF does not tolerate research misconduct in connection with any NSF activities, works to foster and maintain ethical research environments in which RECR is not only taught but practiced, and commits to RECR through increased programmatic investments, specifically the repositioned cross-directorate grants program, Ethical and Responsible Research. In FY 2019, NSF took actions to address the broader definition of the Responsible Conduct of Research (RCR) by: (1) providing a comprehensive definition of RECR in the draft 2020 Proposal and Award Policies and Procedures Guide (PAPPG); (2) implementing NSF's harassment policy; and (3) providing intramural and extramural guidance, resources, and consultation for the inclusion of ethics considerations in citizen science, collaborative/team science, and international science. NSF enhanced mentoring and RCR training guidance by providing: (1) guidance in the draft 2020 PAPPG in such areas as designing RECR training and encouraging the training of faculty in RECR; and (2) funding an Online Ethics Center workshop on training STEM faculty new to teaching ethics. The agency also fostered the implementation of effective RECR training by: (1) continuing to encourage the training of faculty in RECR; (2) encouraging faculty to incorporate RECR into their mentoring, teaching, and curriculum development; and (3) funding an Online Ethics Center workshop on promising practices and innovative programs in RECR.

Our most detailed study of a supermassive black hole

In 1915, Einstein unveiled his general theory of relativity, which holds that the curvature of space and time is responsible for what we perceive as gravity. For a century, the theory has served as the best description of how gravity works. This year, a team of astronomers at UC Los Angeles (UCLA) published the results of direct measurements of gravity near a supermassive black hole. New research could pave the way for revolutionary new developments in how we understand physics and gravity. The team watched a star make a complete orbit in three dimensions around the supermassive black hole at the center of the Milky Way. The full orbit takes 16 years and NSF supported the work for more than two decades, yielding the most detailed study ever conducted into the supermassive black hole and Einstein's general theory of relativity.



Light from a star orbiting the black hole at Milky Way's center shifts as Einstein predicted. *Credit: Nicolle R. Fuller, NSF*

In FY 2020, NSF will take the following actions: (1) publish the final PAPPG and develop further improvements for the 2021 PAPPG based on community feedback; (2) create an RECR landing page on NSF's website that leads directly to NSF's encompassing RECR definition, policies, and programs; (3) increase the incorporation of ethics considerations into NSF research opportunities; (4) continue to fund the Online Ethics Center; and (5) continue to work with academic institutions on promising practices for educating researchers at all levels.

PERFORMANCE

FY 2019 was NSF's first full fiscal year under its new Strategic Plan for FY 2018 – 2022, *Building the Future: Investing in Discovery and Innovation.*[17] This plan, released in FY 2018, lays out two strategic goals that embody the dual nature of NSF's mission to advance the progress of science while benefitting the Nation: *Expand knowledge in science, engineering, and learning and Advance the capability of the Nation to meet current and future challenges*. A third goal, *Enhance NSF's performance of its mission*, directs NSF to hold itself accountable for achieving excellence in carrying out its mission. As shown in the following table, each goal has two strategic objectives which together encompass all areas of agency activity. This goal structure enables NSF to link its investments to longer-term outcomes.

Strategic Goals and Objectives

Strategic Goals	Strategic Objectives
Expand knowledge in science, engineering, and learning.	*1.1 Knowledge* Advance knowledge through investments in ideas, people, and infrastructure.
	1.2 Practice Advance the practice of research.
Advance the capability of the Nation to meet current and future challenges.	*2.1 Societal Impacts* Support research and promote partnerships to accelerate innovation and to provide new capabilities to meet pressing societal needs.
	2.2 STEM Workforce Foster the growth of a more capable and diverse research workforce and advance the scientific and innovation skills of the Nation.
Enhance NSF's performance of its mission.	*3.1 Human Capital* Attract, retain, and empower a talented and diverse workforce.
	3.2 Processes and Operations Continually improve agency operations.

In the Strategic Plan, NSF set an FY 2018 – 2019 Agency Priority Goal (APG) to *Expand public and private partnerships to enhance the impact of NSF's investments and contribute to American economic competitiveness and security*.[18,19] The APG states that by September 30, 2019, NSF's number of partnerships and/or award actions with other federal agencies, private industry, and foundations/philanthropies will grow by 5 percent, relative to the FY 2017 baseline, to make available infrastructure, expertise, and financial resources to the U.S. scientific and engineering research and education enterprise. In FY 2019, NSF continued its practice of having agency leaders conduct quarterly data-driven performance reviews, including reporting on the APG.

[17] *NSF Strategic Plan FY 2018 – 2022*: https://www.nsf.gov/pubs/2018/nsf18045/nsf18045.pdf

[18] Agency Priority Goal – Expand Public and Private Partnerships: https://www.performance.gov/NSF/APG_nsf_1.html

[19] NSF has strategic public-private partnerships that do not meet the thresholds governing financial reporting, per SFFAS 49, "Private Public Partnership: Disclosure Requirements."

NSF participates actively in the President's Management Agenda,[20] most prominently in the implementation of Cross-Agency Priority (CAP) Goals relevant to its mission such as CAP Goal 8, Results-Oriented Accountability for Grants.[21]

Progress Toward Achievement of Performance Goals

Each year, NSF produces an *Agency Financial Report, Annual Performance Report (APR)*, and *Performance and Financial Highlights* summary report. NSF's *FY 2019 APR* will provide a complete discussion of the Foundation's performance measures, including descriptions of the metrics, methodologies, results, and trends, along with a list of relevant external reviews. The topic areas of these goals are listed in the following table. Targets and annual results will be provided in the *FY 2019 APR*. The *FY 2019 APR* will also provide information about NSF's verification and validation review of performance data, as required by the Government Performance and Results Modernization Act of 2010. NSF's *FY 2019 APR* (included in the *FY 2021 Budget Request to Congress)* and *FY 2019 Performance and Financial Highlights* summary report will be posted on the NSF website concurrent with NSF's *FY 2021 Budget Request to Congress* in early February 2020.[22]

FY 2019 Performance Goals

Goal Short Name	Goal Statement
Agency Priority Goal (APG): Expand Public and Private Partnerships	*APG*: Expand public and private partnerships to enhance the impact of NSF's investments and contribute to American economic competitiveness and security.
Ensure that Key Program Investments are on Track	Ensure that key FY 2019 NSF-wide program investments are implemented and on track.
Ensure that Infrastructure Investments are on Track	Ensure program integrity and responsible stewardship of major research facilities and infrastructure.
Make Timely Award Decisions	Inform applicants whether their proposals have been declined or recommended for funding in a timely manner.
Improve Review Quality	Improve the quality of written reviews of NSF proposals.
Foster a Culture of Inclusion	Foster a culture of inclusion through change management efforts resulting in change leadership and accountability.
Align Job Requirements with Competencies	Ensure that employee job requirements are aligned with competencies and skills needed for the future.
Improve User Interactions with Information Technology (IT) Systems	Streamline and simplify user interactions with IT systems and functions that support the merit review process, reducing non-value-added steps and reducing the time spent managing the proposal and award lifecycle.

[20] *President's Management Agenda*: https://www.whitehouse.gov/omb/management/pma
[21] CAP Goal 8: https://www.performance.gov/CAP/CAP_goal_8.html
[22] *FY 2019 Agency Performance Report* (included in the Performance chapter of the FY 2021 Budget Request to Congress) and *FY 2019 Performance and Financial Highlights*: https://www.nsf.gov/about/performance/

Renewing NSF

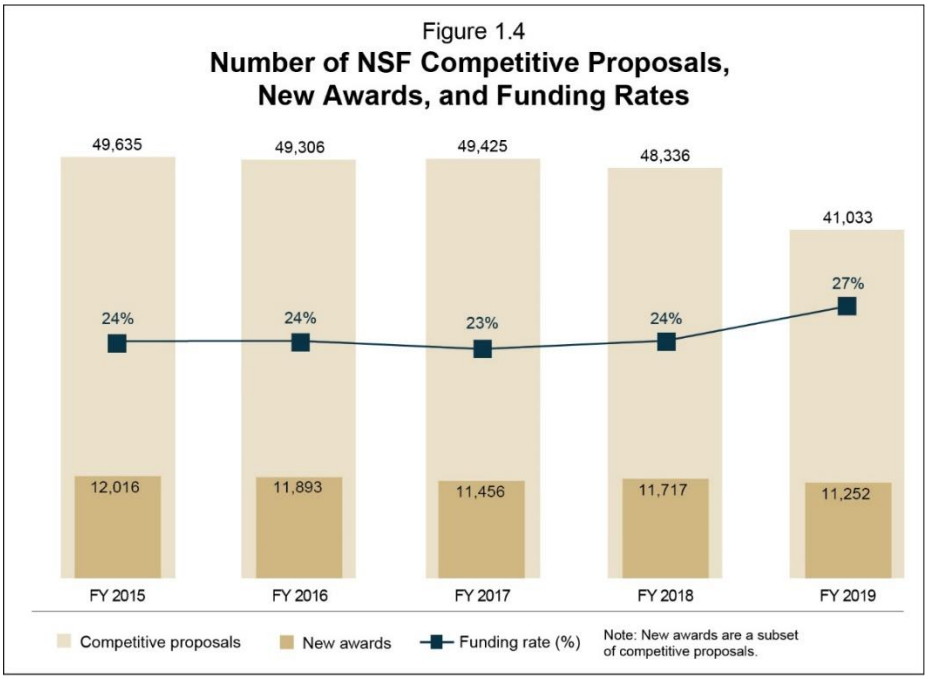
In FY 2019, NSF continued ongoing efforts focused on internal agency reform and process improvement, collectively called "Renewing NSF." Renewing NSF will enhance performance of NSF's mission and maintain U.S. leadership in research and education across all areas of STEM. This effort is aligned with NSF's history of continuous organizational improvement and the Administration's government-wide agency reform activities, and it will yield an even more agile organization better prepared for future challenges and opportunities. The four focus areas are: (1) making information technology work for all; (2) adapting the workforce and the work; (3) streamlining, standardizing, and simplifying processes and practices; and (4) expanding and deepening public and private partnerships. NSF has performance goals supporting all four areas.

Proposal Workload and Management Trends

NSF continuously monitors key portfolio, proposal workload, and financial measures to understand short- and long-term trends and to help inform management decisions. For an analysis of the long-term trends in competitive proposals, awards, funding rate, and other portfolio metrics, see the *Report on the National Science Foundation's Merit Review Process, Fiscal Year 2017*.[23]

Figure 1.4 identifies three key portfolio measures: competitive proposals acted upon, new awards, and funding rates. Of note is the decrease in competitive proposals and the increase in funding rate in FY 2019. NSF is reviewing various factors, including the compressed work year, suspension of normal operations during the lapse in funding, increased NSF appropriations, and the expanded use of no-deadline pilots in some directorates, that may have led to these changes. Analysis will be included in the upcoming FY 2019 merit review report.

Figure 1.4
Number of NSF Competitive Proposals, New Awards, and Funding Rates



[23] *Report on the National Science Foundation's Merit Review Process, Fiscal Year 2017* (NSB-2019-15): https://www.nsf.gov/nsb/publications/2018/nsb201915.pdf

Table 1.1 provides proposal workload and management trends over 5 years. Highlights of these indicators are as follows:

- Between FY 2018 and FY 2019, the number of competitive proposal actions decreased by 15 percent; from 48,336 to 41,033.
- The number of new awards in FY 2019 was 11,252, a 4 percent decrease over FY 2018.
- The overall funding rate in FY 2019 was 27 percent, an increase of 3 percentage points. Funding rates differ by directorate and are presented in the agency's annual budget request to Congress.
- The average annual award size of competitive awards was $197,530, approximately $8,000 higher than in FY 2018. As shown in Table 1.1, award size varies by year. The FY 2019 average annual award size is higher than the 5-year average of $180,450.
- The number of employees (full-time equivalents, or FTE) was stable between FY 2018 and FY 2019, 1,417 FTE and 1,415 FTE, respectively.
- The number of active awards decreased slightly (< 1%) in FY 2019, from 54,386 in FY 2018 to 54,093 in FY 2019. The 5-year average number of active awards is 54,338.

Table 1.1 – Proposal Workload and Management Trends

	Measure	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	Percent Change (FY 2019 FY 2018)	Average (FY 2015 FY 2019)
Portfolio	Competitive proposal actions	49,635	49,306	49,425	48,336	41,033	-15.1%	47,547
	Competitive award actions	12,016	11,893	11,456	11,717	11,252	-4.0%	11,667
	Average annual award size (competitive awards)	$164,526	$176,243	$174,533	$189,418	$197,530	4.3%	$180,450
	Funding rate	24%	24%	23%	24%	27%	+3 percentage points	24%
Proposal	Number of employees FTE, usage[1]	1,374	1,398	1,430	1,417	1,415	-0.1%	1,407
	Number of active awards[2]	53,967	54,439	54,806	54,386	54,093	-0.5%	54,338
	Proposal reviews conducted[3]	231,450	225,017	231,691	223,781	192,033	-14.2%	220,794
Financial	Number of grant payments	22,860	22,926	22,615	21,727	20,935	-3.6%	22,213
	Award expenses incurred but not reported at 9/30 ($ in millions)[4]	$369	$366	$397	$383	$413	7.8%	$386

Notes:

[1] Full-time equivalents (FTE) shown include the federal employee workforce for NSF, NSB, OIG, and U.S. Arctic Research Commission.

[2] Active awards include all active awards regardless of whether funds were received during the fiscal year.

[3] Includes written reviews, panel summaries, and site visit reports.

[4] FY 2019 number reflects an accrual, and all other years reflect actuals estimate.

- All NSF awardee institutions are required to submit payment requests at the award level to the NSF Award Cash Management Service (ACM$). Award expenses are posted to the NSF financial system at the time of the payment request. Reliance on ACM$ reduces the burden of manual invoicing and potential for errors or missed payments.
- Since its introduction in FY 2013, ACM$ has significantly improved the timeliness of grant financial data. In prior years, NSF awardee institutions using quarterly expense reporting processes had approximately $1.7 billion in award expenses that they had incurred but not-yet-reported to NSF on September 30. With the use of ACM$, the amount of incurred but not-yet-reported award expenses has decreased to under $415 million for each of the last 5 years.

New tools to minimize risks in shared, augmented reality environments

Augmented reality (AR) has, thus far, largely been deployed in the context of individuals playing popular video games that allow them to use smart phones or other devices to see virtual objects in the physical world around them. But soon this technology may find applications where groups are using it for learning, commerce or industry – which makes it all the more important to figure out how to safeguard AR from hackers and others who would hijack it or breach the privacy of users. NSF-supported researchers are laying the groundwork for a safe AR universe. Their new toolkit, known as ShareAR, lets app developers build in AR features without sacrificing their users' privacy and security. ShareAR is the first of its kind as it takes into account the unique security issues associated with augmented reality, such as the idea that attackers could add malicious or inappropriate items into the virtual environments.

The team tested ShareAR with three case study apps. One of the apps is Doc Edit (above), which lets users create virtual notes or lists they can share or keep private; the semi-transparent gray box in the top left corner represents a "ghost object," or a document that another user wishes to remain private. *Credit:* Ruth et al., USENIX Security Symposium

FINANCIAL DISCUSSION AND ANALYSIS

Throughout FY 2019, NSF upheld its commitment to excellence in financial management by continuing its focus on fiscal responsibility, improved business processes, increased data transparency, responsible stewardship of federal funds, and accountability. In FY 2019, financial highlights included:

- *Robotic Process Automation (RPA):* NSF's RPA initiative goals are to make information technology work for us by increasing productivity, reducing waste by eliminating manual processes, improving financial management program effectiveness, reducing transaction errors and increasing reliability, and shifting staff time to value-added analytical work. In FY 2019, NSF completed a Department of Treasury RPA pilot and evaluation. As a result, the agency established an RPA program and implemented its first series of 'bots' to perform actions for Intra-Governmental Payment and Collection System transactions. In addition, the agency participated on a government-wide study to explore distributed ledger technology (DLT) and launched an NSF Treasury DLT follow-up project to develop a prototype for its Award Cash Management Services payment management system.

Collision-detecting suitcase

For the visually impaired, unfamiliar environments can prove difficult to navigate. A team of NSF-supported researchers are working to make at least one of those environments safer, with a smart suitcase that warns blind users of impending collisions, along with a wayfinding smartphone app for safe and independent navigation through airport terminals. The rolling suitcase sounds alarms when users are headed for a collision with a pedestrian, and the navigation app provides turn-by-turn audio instructions to users on how to reach a departure gate — or a restroom or a restaurant. The app, known as NavCong, employs airports' Bluetooth beacons, for navigation waypoints.

Researchers have developed a smart suitcase that helps blind travelers navigate crowded airports. *Credit: Carnegie Mellon University*

- *Awards Systems Modernization Efforts*: NSF continued to improve its awards system as part of the agency's multi-year initiative to modernize and consolidate its suite of e-business systems. The agency migrated post-award funding actions from the legacy Awards System to the MyNSF platform. MyNSF provides a single point-of-entry with access to the information and systems staff use to complete merit review activities online. In addition, the agency implemented enhanced reporting capabilities through a Business Intelligence reporting tool, deployed new functionality for grants officers, and enhanced the reuse of information across systems. These efforts ensure NSF conducts work proficiently and expediently, while reducing legacy systems costs.

- *Enterprise Risk Management (ERM):* NSF completed its third year of integrating ERM practices throughout the agency to improve decision-making and enhance performance by more closely linking strategy and objectives to risk. NSF expanded its risk reporting to better articulate the agency's risk appetite as a continuum that guides decision-making on allocating risk management resources and efforts. The agency integrated risk management practices in a range of risk categories from strategic and operational risk, to financial and compliance risk. Most significantly, as a result of OMB's new guidance to shift from low- to high-value work, NSF seized risk opportunities in areas such as shared services, robotic processing automation innovation, and leveraging data as a strategic asset. Going forward, NSF will continue to expand its discussions about risk across the agency with the goal of fully integrating ERM into its strategic planning, budget formulation, performance assessment, and quality control improvements.

New NSF Regional Class Research Vessel

Regional Class Research Vessels, or RCRVs, are gateways to the oceans for researchers. Able to cruise for weeks at a time, traveling thousands of miles offshore, these vessels allow scientists to travel to crucial research zones carrying cutting-edge instruments. NSF has been working for years to build a new fleet of RCRVs. In FY 2019, the agency selected the Gulf – Caribbean Oceanographic Consortium as the operator for its third new RCRV, scheduled to begin construction in late 2019. The vessel will be designed for operations throughout the Gulf of Mexico, Caribbean Sea, and Atlantic Ocean. At 199 feet long and 41 feet wide, the ship will feature science labs, deck space for scientific deployments, tools for seafloor mapping, and telepresence capabilities that will allow land-based scientists to participate in research at sea.

Rendering of a Regional Class Research Vessel. Credit: *Glosten, University of Southern Mississippi (USM)*

- *DATA Act:* NSF completed a Data Quality Plan (DQP) to provide a foundation to verify and validate the completeness, timeliness, quality, and accuracy of NSF data. The DQP developed NSF's FY 2019 approach to achieve reasonable assurance for internal control over quarterly DATA Act reporting and was prepared in accordance with OMB M-18-16, Appendix A to OMB Circular A-123, "Management of Reporting and Data Integrity Risk." The DQP includes a five-step process covering significant milestones and major decisions pertaining to organizational structure, internal controls and management's responsibility to report quality spending data and identifying high risks and linkages between the NSF award and financial systems. Further details on NSF's DATA Act status may be found in Chapter 3, Appendix 2B, Management Challenges—NSF Response, of this *AFR*.
- *Personal Identity Verification (PIV) Card Access to Treasury Systems:* In cooperation with the Department of the Treasury, NSF implemented PIV card access to multiple Treasury systems NSF uses daily for payment operations. PIV card access eliminates the need for specialized security tokens, facilitates remote access, and simplifies processes for NSF staff. It also leads to more efficient payment processes, while assuring appropriate levels of security for all applicable Federal applications.
- *Smart Pay 3 Initiative*: NSF implemented the Citibank travel and purchase card program. The agency completed the project on-time and with no interruption in service for NSF cardholders. The transition included updates to the NSF Government Travel Charge Card Guide and online travel card training through LearnNSF.

In accordance with the Chief Financial Officers (CFO) Act and the Government Management Reform Act of 1994, NSF prepares financial statements in conformity with Generally Accepted Accounting Principles (GAAP) for federal entities. The financial statements present NSF's detailed financial information relative to its mission and the stewardship of those resources entrusted to the agency. They also provide readers with an understanding of the resources that NSF has available, the cost of its programs, and the status of resources at the end of the fiscal year. NSF's financial statements have undergone an independent audit to ensure that they are free from material misstatement and can be used to assess NSF's financial status and related financial activities for the year ending September 30, 2019.

NSF received an unmodified audit opinion on its financial statements, and no material weaknesses or significant deficiencies were identified in the internal control program for financial reporting. The Independent Auditor's Report begins on the first page of Chapter 2, *Financials*. Management's response follows the audit report.

Understanding the Financial Statements

The following discussion of NSF's financial condition and results of operations should be read together with the FY 2019 financial statements and accompanying notes, found in Chapter 2, Financials, of this *AFR*.

In accordance with guidance in OMB Circular No. A-136, "Financial Reporting Requirements," NSF's FY 2019 financial statements and notes are presented in a comparative format to facilitate analysis of FYs 2019 and 2018. The Stewardship Investments schedule, also in Chapter 2, presents research and human capital investments over the past 5 years. Table 1.2 summarizes the changes in NSF's financial position in FY 2019 relative to FY 2018.

Table 1.2 – Changes in NSF's Financial Position in FY 2019
(Dollars in Millions)

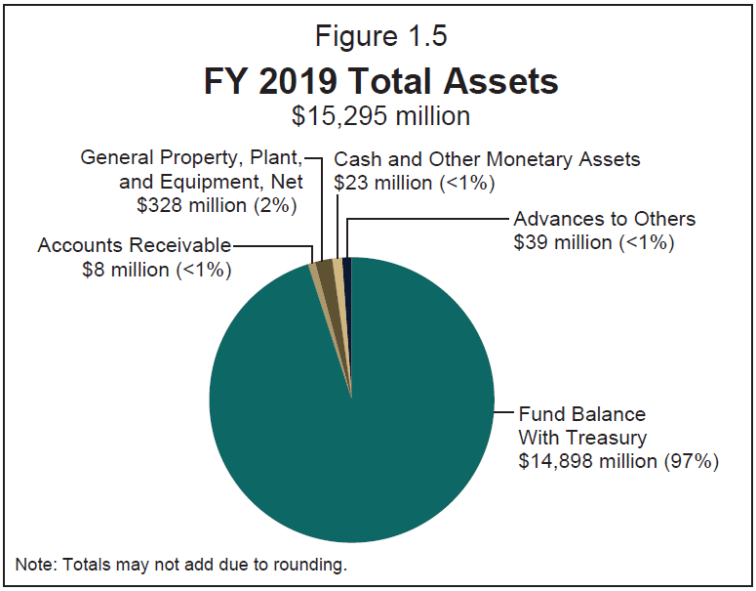
Net Financial Condition	FY 2019	FY 2018	$ Change	% Change
Assets	$15,295	$14,352	$943	7%
Liabilities	$541	$493	$48	10%
Net Position	$14,754	$13,859	$895	6%
Net Cost	$7,320	$7,232	$88	1%

Balance Sheet

The Balance Sheet presents the total amounts available for use by NSF (assets) against the amounts owed (liabilities) and amounts that comprise the difference (net position). NSF's total assets are largely composed of *Fund Balance with Treasury*.

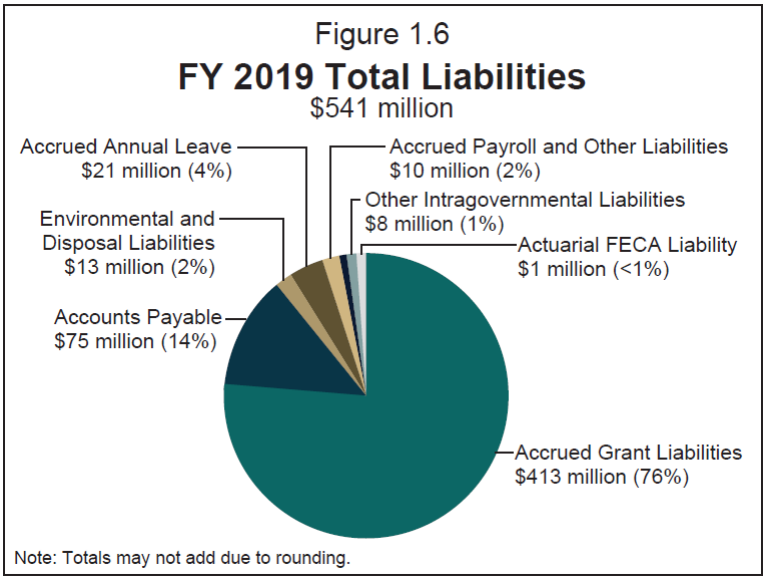
In FY 2019, Total Assets increased 7 percent from FY 2018 (Figure 1.5). The majority of the change occurred in the *Fund Balance with Treasury* account, which increased by $918 million in FY 2019. NSF is authorized to use *Fund Balance with Treasury* to make expenditures and pay amounts due through the disbursement authority of Treasury. The *Fund Balance with Treasury* is increased through appropriations and collections and decreased by expenditures and rescissions.

Figure 1.5



In FY 2019, Total Liabilities increased by 10 percent from FY 2018 (Figure 1.6). Driving this change was a $20 million increase in *Accounts Payable* in addition to a $20 million increase in *Accrued Grant Liabilities* in FY 2019. *Accounts Payable* is estimated annually by utilizing historical data based on the actual expenses incurred but not reported, as a percentage of current fiscal year expenses. The majority of the FY 2019 change was due to a modification of the methodology used to estimate *Accounts Payable*, resulting in an increase as compared to FY 2018. *Accrued Grant Liabilities* is estimated annually by utilizing a linear regression model based on the statistical correlation of NSF grantees' historical unliquidated obligations and expenses incurred but not reported. In FY 2019, the unliquidated obligations balance for grantees increased, resulting in a higher *Accrued Grant Liabilities* as compared to FY 2018.

Figure 1.6



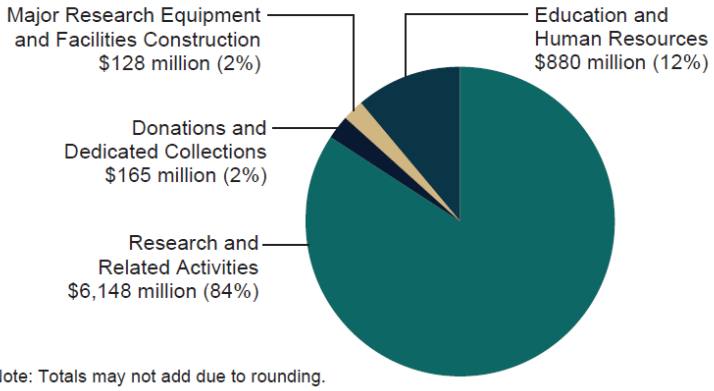
Statement of Net Cost

The Statement of Net Cost presents the annual cost of operating NSF programs. The net cost of operations of each NSF program equals the program's gross cost less any offsetting revenue. Intragovernmental earned revenues are recognized when related program or administrative expenses are incurred. Earned revenue is deducted from the full cost of the programs to arrive at the *Net Cost of Operations*.

Figure 1.7

FY 2019 Total Net Cost

$7,320 million



Note: Totals may not add due to rounding.

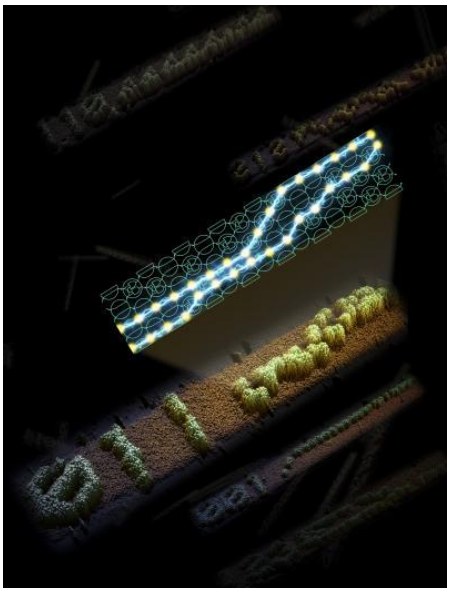
Approximately 95 percent of FY 2019 *Net Cost of Operations* was directly related to the support of R&RA, EHR, MREFC, and Donations and Dedicated Collections. Additional costs were incurred for indirect general operation activities (e.g., salaries, training, and activities related to the advancement of NSF information systems technology) and activities of the NSB and the OIG. These costs were allocated to R&RA, EHR, MREFC, and Donations and Dedicated Collections and account for approximately 5 percent of FY 2019 *Net Cost of Operations* (Figure 1.7). These administrative and management activities support the agency's program goals.

Statement of Changes in Net Position

The Statement of Changes in Net Position presents the agency's cumulative results of operations and unexpended appropriations for the fiscal year. NSF's *Total Budgetary Financing Sources*, as part of *Unexpended Appropriations*, increased by $166 million; and *Total Financing Sources*, as part of *Cumulative Results of Operations*, increased by $144 million in FY 2019 for a total increase of $310 million. *Cumulative Results of Operations* increased by $69 million.

Reprogrammable Molecular Computing System

NSF-supported computer scientists have designed a different kind of computer, one that uses DNA molecules instead of transistors. Researchers have for years explored the potential of DNA computers, but what makes this new one different is that, for the first time, its "hardware" can be configured to run different "software" – they're reprogrammable. The system uses DNA molecules to represent six-bit binary numbers. They perform simple computations for now and likely won't replace standard silicon microchip computers anytime soon, but they offer the potential to perform increasingly complex computations in the long run. And they are already teaching researchers about how molecular processes can encode information and carry out algorithms.



Artist's representation of a DNA computing system. *Credit: California Institute of Technology (Caltech)*

Statement of Budgetary Resources

This statement provides information on how budgetary resources were made available to NSF for the year and the status of those budgetary resources at year end. For FY 2019, *Total Budgetary Resources* increased $328 million from the FY 2018 level. *Budgetary Resources—Appropriations* in FY 2019 for the R&RA, EHR, and MREFC accounts were $6,505 million, $922 million, and $296 million, respectively. The combined *Budgetary Resources—Appropriations* in FY 2019 for the NSB, the OIG, and AOAM accounts totaled $353 million. NSF also received funding via warrant from the H-1B Nonimmigrant Petitioner Account (H-1B) in the amount of $157 million and via donations from foreign governments, private companies, academic institutions, nonprofit foundations, and individuals in the amount of $32 million. In FY 2019, the *Budgetary Resources—Appropriations* line was also affected by H-1B sequestration in the amount of $10 million.

Stewardship Investments

NSF-funded investments yield long-term benefits to the public. NSF investments in research and education produce quantifiable outputs, including the number of awards made and the number of researchers, students, and teachers supported or involved in the pursuit of science and engineering research and education. NSF incurs stewardship costs as part of its longstanding commitment to invest in learning and discovery. In FYs 2019 and 2018, these costs amounted to $372 million and $395 million, respectively.

Limitations of the Financial Statements

In accordance with the guidance provided in OMB Circular No. A-136, NSF discloses the following limitations of the agency's FY 2019 financial statements. The principal financial statements are prepared to report the financial position and results of operations of NSF, pursuant to the requirements of 31 U.S.C. 3515(b). The statements are prepared from the books and records of NSF in accordance with federal GAAP and the formats prescribed by OMB. Reports used to monitor and control budgetary resources are prepared from the same books and records. The financial statements should be read with the realization that they are for a component of the U.S. Government.

Other Financial Reporting Information

Debt Collection Improvement Act of 1996

Net Accounts Receivable totaled $7.8 million at September 30, 2019. Of that amount, $7.2 million was due from other federal agencies. The remaining $600,000 was due from the public. In accordance with the Debt Collection Improvement Act, as amended by the DATA Act, NSF fully participates in Treasury's Cross-Servicing Program. This program requires NSF to refer debts due from the public that are delinquent more than 120 days to Treasury for appropriate collection action. In accordance with OMB Circular No. A-129, "Policies for Federal Credit Programs and Non-Tax Receivables," NSF writes off delinquent debt that is more than 2 years old. Additionally, NSF seeks Department of Justice concurrence for the write-off of debts greater than $100,000.

Cash Management Improvement Act of 1990

In FY 2019, NSF had no awards covered under Cash Management Improvement Act Treasury-State Agreements. The timeliness of NSF's payments to grantees through its payment systems makes the issue of timeliness of payment under the Act essentially not applicable to the agency. No interest payments were made in FY 2019.

SYSTEMS, CONTROLS, AND LEGAL COMPLIANCE

Management Assurances

The Federal Managers' Financial Integrity Act of 1982 (FMFIA)[24] and the OMB Circular A-123, "Management's Responsibility for Enterprise Risk Management and Internal Control"[25] require NSF to evaluate its systems of internal control and provide reasonable assurance to the President and the Congress on the adequacy of those systems, annually.

In FY 2019, NSF began to transition its highly successful Internal Control and Quality Assurance Program into a Data Analytics Assurance Program. This transition will position NSF for future success in meeting government-wide requirements for managing risks and maintaining effective internal controls. There are four specific areas of concentration: (1) dealing with the proliferation of data, (2) leveraging artificial intelligence and automation, (3) managing and reducing the cost of risk management, and (4) building a stronger NSF/CFO organization.

National Science Foundation

FY 2019 Statement of Assurance

The National Science Foundation (NSF) management is responsible for managing risks and maintaining effective internal control to meet the objectives of Sections 2 and 4 of the Federal Managers' Financial Integrity Act (FMFIA). The NSF conducted its assessment of risk and internal control processes in accordance with OMB Circular No. A-123, *Management's Responsibility for Enterprise Risk Management and Internal Control*. Based on the results of the assessment, NSF can provide reasonable assurance that internal control over operations, reporting, and compliance was operating effectively as of September 30, 2019.

/s/
France A. Córdova
Director

November 14, 2019

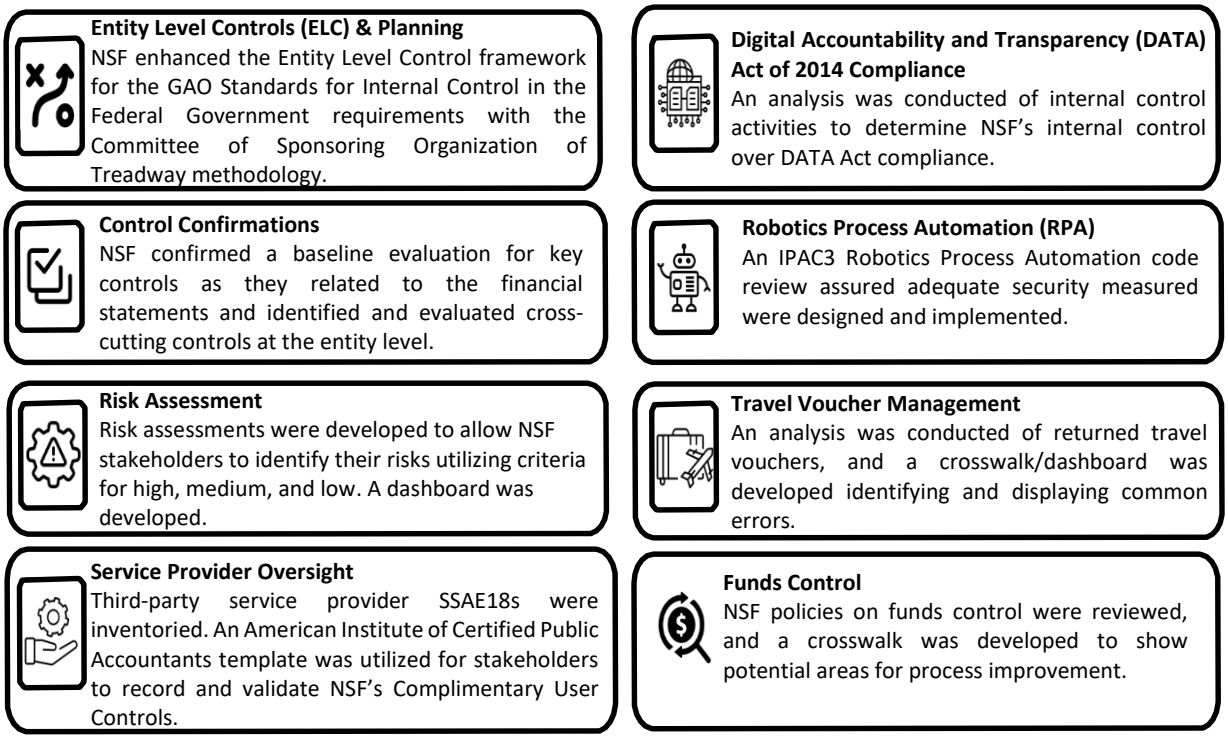
The FY 2019 unmodified Statement of Assurance, with no material weaknesses, is reasonable assurance to the overall adequacy and effectiveness of internal controls based upon information that the system of internal control is operating as intended.

NSF's internal control assessment provides reasonable assurance that the objectives of FMFIA and the Federal Financial Management Improvement Act of 1996 (FFMIA) were achieved and that the internal control process over financial reporting is effective.

[24] FMFIA: https://obamawhitehouse.archives.gov/omb/financial_fmfia1982
[25] OMB Circular A-123: https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2016/m-16-17.pdf

Highlights from NSF's FY 2019 Internal Control Quality Assurance Program

In accordance with the updated OMB Circular A-123, Appendix A, "Internal Control Over Reporting," NSF applied a practical and effective approach in determining which control activities to document, assess, and report to achieve the objective of internal control over reporting. The following graphic summarizes FY 2019 program accomplishments:



Management of Reporting and Data Integrity Risk—OMB Circular A-123, Appendix A

In November 2018, NSF initiated its DQP to develop the agency's FY 2019 approach to achieve reasonable assurance for internal control over quarterly DATA Act reporting. The DQP was prepared in accordance with OMB M-18-16, Appendix A to OMB Circular No. A-123, "Management of Reporting and Data Integrity Risk." NSF concluded that the internal controls for data quality and DATA Act reporting provide reasonable assurance regarding the accuracy of DATA Act reporting of the 57 requisite elements and that the reporting process is reliable and valid.

Improving the Management of Government Charge Card Programs—OMB Circular A-123, Appendix B

In 2019, NSF moved to a new purchase and travel card vendor. The new vendor provides enhanced access to data and reports within their service and enables NSF to strengthen roles and responsibilities within the charge card program and continually improve monitoring for misuse. The charge card program was included as part of the FY 2018 improper payments risk assessment and the FY 2019 improper payments risk review. The FY 2019 risk review process included a review of the charge card monitoring activities and reviews of selected charge card transactions. There were no significant issues noted. NSF determined that there is not a significant risk of improper payments for the charge card program. In January 2019, the NSF

OIG issued a letter noting that there were no outstanding audit recommendations for purchase and travel charge cards.

Requirements for Effective Estimation and Remediation of Improper Payments—OMB Circular A-123, Appendix C

Assessment of FY 2018 Improper Payments: During FY 2018, NSF completed a qualitative risk assessment of FY 2018 improper payments through June 30, 2018. On May 10, 2019, the NSF OIG issued report number OIG 19-2-005 on NSF's compliance with IPERA requirements for FY 2018. The OIG concluded NSF complied with the requirements of IPERA.

Assessment of FY 2019 Improper Payments: During the third and fourth quarters of FY 2019, NSF completed a qualitative risk review of FY 2019 improper payments through June 30, 2019. The risk review determined NSF did not have significant risk of improper payments for grants, contracts, charge cards, and payments to employees. The risk review was completed as the first step of an overall 3-year risk assessment cycle that will be comprised of risk reviews in 2019 and 2020 and culminates with the results of those 2 years rolled forward and combined with the 2021 risk assessment activities.

Compliance with the Federal Financial Management Improvement Act of 1996 (FFMIA)—OMB Circular A-123, Appendix D

OMB Circular A-123, Appendix D provides guidance in determining compliance with FFMIA for agencies subject to the CFO Act. NSF leveraged work from Appendix A and focused efforts on implementing the Statement of Standards for Attestation Engagements (SSAE) 18 process to demonstrate both the iTRAK service provider and NSF have the appropriate controls designed and in place, including the Complementary User Entity Controls. NSF's service provider received a clean opinion on the service auditor type 2 System and Organization Controls Report, which is relevant to internal control over financial reporting. The auditors' opinion addressed the accuracy and completeness of the design of controls and service. NSF developed goals and compliance indicators and established compliance with Appendix D requirements. No significant deficiencies or material weaknesses in internal control over FFMIA compliance were identified.

Federal Information Security Modernization Act (FISMA) of 2014: NSF has established a comprehensive IT Security and Privacy Program that is consistent with FISMA and industry best practices. NSF's IT controls are effective in maintaining a secure IT environment and align with the National Institute of Standards and Technology Framework for Improving Critical Infrastructure. The agency's IT environment is supported by a suite of comprehensive policies and procedures that incorporate federal mandates and guidance. NSF has a strong Information Security Continuous Monitoring program that includes the Department of Homeland Security Continuous Diagnostic and Mitigation technologies. NSF includes cybersecurity as part of its ERM program. The OMB Cybersecurity Risk Management Assessment evaluated NSF's overall management of cybersecurity risk and confirmed that NSF has implemented appropriate security protections. Improved technologies and continuous monitoring enhance and verify an effective IT Security and Privacy Program.

Other Federal Reporting and Disclosure

Anti-Deficiency Act (ADA): NSF is not aware of any ADA violations that are required to be reported for the year ended September 30, 2019.

Digital Accountability and Transparency Act of 2014 (DATA Act): The DATA Act is a government-wide initiative led by OMB and Treasury to standardize and publish the federal government's wide variety of reports and data compilations related to spending. NSF successfully met the DATA Act's requirement for federal agencies to begin submitting data to Treasury by May 2017 and implemented corrective actions sufficient to close all recommendations of a November 2017 OIG audit, as required by the DATA Act. NSF, subsequently, conducted a root cause analysis of its challenges related to the DATA Act. The agency continues to provide leadership and engagement in government-wide DATA Act work, which includes developing a DQP in accordance with OMB-issued guidance in June 2019. Based on NSF's risk-based evaluation and analysis of causes and actions taken, NSF is confident that its risk of reporting inaccurate, incomplete, or untimely data has been significantly reduced.

Pay and Allowance System for Civilian Employees, provided primarily in Chapters 31–50 of Title 5, U.S.C.: The Department of the Interior, Interior Business Center (IBC) Federal Personnel/Payroll System (FPPS) is a Shared Service Provider and performs many of NSF's payroll functions. IBC FPPS's internal control is reviewed annually by auditors under SSAE 18. IBC FPPS's controls are found to be suitably designed and operating effectively. This conclusion is based partly on transactional testing.

Prompt Payment Act: The Prompt Payment Act mandates interest penalties on payments over 30 days. Under OMB Memorandum 17-27, "Reducing Burden for Federal Agencies by Rescinding and Modifying OMB Memoranda," NSF encourages accelerating payments to all contractors within 15 days of a proper invoice being received. This acceleration allows small business contractors to be paid as quickly as possible.

Government Charge Card Abuse Prevention Act of 2012, Pub. L. 112 – 194: The act requires that agencies eensure that appropriate policies and controls are in place or that corrective actions have been taken to mitigate the risk of fraud and inappropriate charge card practices. NSF provides reasonable assurance that internal controls related to the Government Charge Card Programs are operating effectively, and no material weaknesses were identified. Additional information is provided above in subsection Improving the Management of Government Charge Card Programs—OMB Circular A-123, Appendix B, page MD&A-27.

Provisions Governing Claims of the U.S. Government (31 U.S.C. 3711–3720E) (Including the Debt Collection Improvement Act of 1996): The Debt Collection Improvement Act is addressed on page MD&A-25.

Federal Information Security Modernization Act of 2014: This topic is addressed above in subsection Compliance with the Federal Financial Management Improvement Act of 1996—OMB Circular A-123, Appendix D, page MD&A-28.

Single Audit Act of 1984, Pub L. No. 98-502, and the Single Audit Act Amendments of 1996, P.L. 104-156. (A-136, section II.2.8): In accordance with 2 § CFR 200.501, Subpart F, Audit Requirements, non-federal entities that expend $750,000 or more during the non-federal entity's fiscal year in federal awards must have a single or program specific audit conducted for that year. Federal agency internal control standards determine whether award expenditures comply with laws and regulations. NSF, like other federal agencies, is required to review the findings and recommendations of audit reports for funding recipients to determine whether corrective actions (if required) are adequate and implemented. NSF utilizes guidance from the OMB Uniform Administrative Requirements, Cost Principles, and Audit Requirements

for Federal Awards (Uniform Guidance) and Audit Follow-up as a basis for its audit resolution and follow-up activities. During FY 2019, NSF resolved 152 single audit reports.

NSF continues to ensure that its policies and procedures fully align with federal requirements. The agency continually assesses the effects changes in policies and practices may have on NSF's stewardship over its mission-related activities. NSF continues to strengthen audit resolution and other oversight functions by deepening the subject matter expertise of its staff and the effective utilization of available resources. In addition, NSF maintains formal, ongoing dialogue with the OIG to address issues affecting audit resolution (e.g., new methodologies), as well as the interpretation and application of NSF policies and procedures and overall stewardship of NSF resources.

Financial System Strategy and Framework

Financial System Strategy

iTRAK is NSF's Oracle-based commercial-off-the-shelf financial system hosted in the 'cloud' by a commercial hosting provider. iTRAK provides automated business processes and improved funds management and reporting capabilities for NSF's external and internal customers, including grantees, financial and administrative staff, and program managers. iTRAK also performs system edit checks and provides audit trails for financial transactions, thereby strengthening internal controls. iTRAK aligns with NSF's strategic objective to continually improve agency operations by enabling efficient, effective execution of financial activities and business operations; and it supports the agency in its stewardship role by providing managers and staff with financial data and reports, so they may make informed decisions about the programs they manage and support. For example, an iTRAK Open Obligations Reporting Tool was developed to assist NSF staff with prioritizing the review of open obligations and understanding the related funding impacts. The reporting tool supports NSF's efforts to continuously employ sound financial management and stewardship funding practices to fully utilize resources.

iTRAK complies with federal mandates and regulations by ensuring that transactions are posted in accordance with the United States Standard General Ledger (USSGL) at the transaction level; maintaining accounting data to permit reporting in accordance with GAAP as prescribed by the Federal Accounting Standards Advisory Board. iTRAK also complies with OMB Circular A-130, "Managing Federal Information as a Strategic Resource," and OMB Circular A-123, Appendix D, "Compliance with the Federal Financial Management Improvement Act of 1996," and with other federal regulations and guidance such as the CFO Act, FISMA, and the Rehabilitation Act, Section 508.

In April 2019, OMB issued M-19-16, "Centralized Mission Support Capabilities for the Federal Government." The objective of this guidance is to develop a new approach to Shared Services that will reduce duplication, improve accountability, and improve Federal shared services. This is one of the focus areas of the President's Management Agenda that centers on the Sharing Quality Services Cross Agency Priority Goal and improvements to Government mission-support services. In alignment with this goal, NSF is working closely with OMB and the Department of Treasury to identify financial management processes and systems that meet the objectives of this memorandum while freeing up critical resources to focus on NSF mission critical outcomes.

In FY 2019, an independent accounting firm examined iTRAK's IT controls. The assessment was favorable with no significant findings. Details about the review are on page MD&A-28 in the subsection, *Compliance with the Federal Financial Management Improvement Act of 1996 –OMB Circular A-123, Appendix D.*

As iTRAK continues to mature, NSF will continue to expand its analytical capabilities toward a more performance-driven system through reporting and data analytics tools and dashboards to better support NSF's mission. In keeping with this objective, NSF will continue to explore opportunities for iTRAK reporting and integration enhancements. In FY 2019, NSF implemented the General Services Administration (GSA) SmartPay 3 initiative that integrated iTRAK to Citibank's system for recording NSF's purchase and travel card transactions. Future initiatives on the horizon are summarized below with anticipated implementation dates:

Integration Initiatives

- G-invoicing (FY 2022) – NSF will integrate with Treasury's new G-invoicing system which will serve as the front-end application for users to originate and manage interagency agreements.
- NSF Business Applications (NBAs) Account Code Structure (ACS) – NSF will modernize its NBAs' ACS to align with iTRAK's current structure, thereby streamlining data and reporting standards across NSF.
- GSA's System for Award Management (SAM) Unique Entity Identification (UEI) (FY 2021) – NSF will implement GSA's UEI requirements in place of the DUNS # as the primary key for institutions/vendors doing business with the federal government. This requires enhancements to iTRAK and certain NBAs.

Reporting Initiatives

- Financial Management Indicators (FMI) Dashboard (FY 2020) – As a next generation offering, an FMI Dashboard will be developed to provide more real-time, dashboard, and drill down reporting of open obligations.

Financial Management System Framework

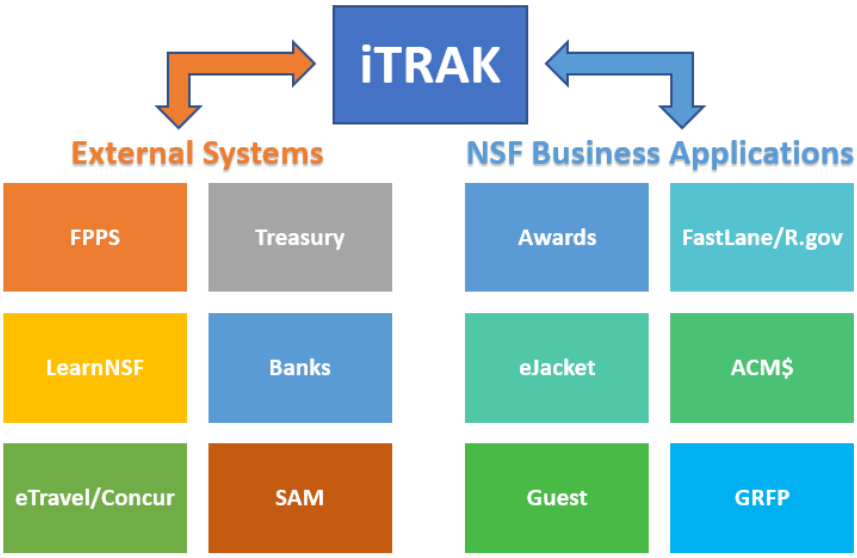
NSF's financial management system framework focuses on the Foundation's financial management systems, standard business processes, data, and information architecture to ensure reliable, timely, and consistent financial information that enables effective management of NSF resources and delivery of mission critical products and services (Figure 1.8).

NSF's core financial system, iTRAK, interfaces with NSF's awards, grants management, and business process systems including:

- ACM$;
- Award Management and Award Letter System ("Awards");
- eJacket, NSF's internal awards processing system;
- Research.gov and FastLane, NSF's websites through which researchers, research administrators and their organizations, and reviewers interact with NSF;
- GRFP system; and
- Guest Travel and Reimbursement System.

iTRAK also interfaces with external systems operated by Treasury; Citibank and LearnNSF, the Foundation's training system; and with other federal systems such as FPPS, eTravel/Concur, and GSA's SAM.

Figure 1.8—NSF Financial Management System Framework



Chapter 2

Financials

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, Virginia 22314

MEMORANDUM

DATE: November 14, 2019

TO: Dr. Diane L. Souvaine
Chair
National Science Board

Dr. France A. Córdova
Director
National Science Foundation

FROM: Allison C. Lerner
Inspector General
National Science Foundation

SUBJECT: Audit Report No. 20-2-001, Audit of the National Science Foundation's Fiscal Years 2019 and 2018 Financial Statements

This memorandum transmits the Kearney & Company, P.C.'s reports on its financial statement audit of the National Science Foundation (NSF) for FY 2019, which includes FY 2018 comparative information.

Audit Reports on Financial Statements; Internal Control over Financial Reporting; and Compliance with Laws, Regulations, Contracts, and Grant Agreements

The *Chief Financial Officer's (CFO) Act of 1990* (Pub. L. No. 101-576), as amended, requires that NSF's Inspector General or an independent external auditor, as determined by the Inspector General, audit NSF's financial statements in accordance with *Government Auditing Standards* (GAS) issued by the Comptroller General of the United States. We contracted with the independent certified public accounting firm Kearney & Company, P.C. (Kearney) to audit NSF's financial statements as of September 30, 2019, and for the fiscal year then ended. The contract requires that the audit be performed in accordance with GAS, the Office of Management and Budget Bulletin 19-03, *Audit Requirements for Federal Financial Statements*, and the U.S. Government Accountability Office/Council of the Inspectors General on Integrity and Efficiency *Financial Audit Manual*.

For Fiscal Year 2019 Kearney provided: (1) its opinion on the financial statements, (2) a report on internal control over financial reporting, and (3) a report on compliance with laws, regulations, contracts, and grant agreements. In its audit of NSF, Kearney:

- Found that the financial statements referred to above present fairly, in all material respects, the financial position of NSF as of September 30, 2019 and 2018, and its net cost of operations,

changes in net position, and budgetary resources for the years then ended, in accordance with accounting principles generally accepted in the United States of America.
- Identified no material weaknesses in internal control over financial reporting.[1]
- Identified no instances in which NSF's financial management systems did not substantially comply with the *Federal Financial Management Improvement Act of 1996* (FFMIA).[2]
- Identified no reportable instances of noncompliance with provisions of laws, regulations, contracts, and grant agreements tested or other matters.

NSF's response to the draft reports, dated November 14, 2019, follows Kearney's reports.

Kearney is responsible for the attached auditor's reports dated November 14, 2019, and the conclusions expressed therein. We do not express opinions on NSF's financial statements or internal control over financial reporting, or on whether NSF's financial management systems substantially complied with the three requirements of FFMIA, or conclusions on compliance and other matters.

Kearney's Independent Auditor's Report is meant only to be distributed and read as part of the Agency Financial Report (AFR). Also, Kearney's Independent Auditor's Report is not a stand-alone document because it refers to the AFR contents and should not be circulated to anyone other than those receiving this transmittal.

We thank your staff for the assistance that was extended to the auditors during this audit. If you have any questions regarding this report, please contact Mark Bell, Assistant Inspector General, Office of Audits, at 703.292.7100 or OIGpublicaffairs@nsf.gov.

Attachments

[1] A material weakness is significant deficiency, or combination of significant deficiencies, that results in more than a remote likelihood that a material misstatement of the financial statements will not be prevented or detected.
[2] Pub. L. No. 104-208

KEARNEY& COMPANY

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INDEPENDENT AUDITOR'S REPORT

To the Director and Inspector General of the National Science Foundation

Report on the Financial Statements

We have audited the accompanying financial statements of the National Science Foundation (NSF), which comprise the balance sheets as of September 30, 2019 and 2018, the related statements of net cost and changes in net position, and the combined statements of budgetary resources (hereinafter referred to as the "financial statements") for the years then ended, and the related notes to the financial statements.

Management's Responsibility for the Financial Statements

Management is responsible for the preparation and fair presentation of these financial statements in accordance with accounting principles generally accepted in the United States of America; this includes the design, implementation, and maintenance of internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditor's Responsibility

Our responsibility is to express an opinion on these financial statements based on our audits. We conducted our audits in accordance with auditing standards generally accepted in the United States of America; the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States; and Office of Management and Budget (OMB) Bulletin No. 19-03, *Audit Requirements for Federal Financial Statements*. Those standards and OMB Bulletin No. 19-03 require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. Accordingly, we express no such opinion. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

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Opinion

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of NSF as of September 30, 2019 and 2018, and its net cost of operations, changes in net position, and budgetary resources for the years then ended, in accordance with accounting principles generally accepted in the United States of America.

Other Matters

Required Supplementary Information

Accounting principles generally accepted in the United States of America require that the Management's Discussion and Analysis, Required Supplementary Stewardship Information, and Required Supplementary Information as named in the Agency Financial Report (hereinafter referred to as the "required supplementary information") be presented to supplement the financial statements. Such information, although not a part of the financial statements, is required by OMB and the Federal Accounting Standards Advisory Board (FASAB), who consider it to be an essential part of financial reporting for placing the financial statements in an appropriate operational, economic, or historical context. We have applied certain limited procedures to the required supplementary information in accordance with auditing standards generally accepted in the United States of America, which consisted of inquiries of management regarding the methods of preparing the information and comparing it for consistency with management's responses to our inquiries, the financial statements, and other knowledge we obtained during our audits of the financial statements. We do not express an opinion or provide any assurance on the information because the limited procedures do not provide us with sufficient evidence to express an opinion or provide any assurance.

Other Information

Our audits were conducted for the purpose of forming an opinion on the financial statements taken as a whole. Other Information, as named in the Agency Financial Report (AFR), is presented for purposes of additional analysis and is not a required part of the financial statements. Such information has not been subjected to the auditing procedures applied in the audits of the financial statements; accordingly, we do not express an opinion or provide any assurance on it.

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Other Reporting Required by *Government Auditing Standards*

In accordance with *Government Auditing Standards* and OMB Bulletin No. 19-03, we have also issued reports, dated November 14, 2019, on our consideration of NSF's internal control over financial reporting and on our tests of NSF's compliance with provisions of applicable laws, regulations, contracts, and grant agreements, as well as other matters for the year ended September 30, 2019. The purpose of those reports is to describe the scope of our testing of internal control over financial reporting and compliance and the results of that testing, and not to provide an opinion on internal control over financial reporting or on compliance and other matters. Those reports are an integral part of an audit performed in accordance with *Government Auditing Standards* and OMB Bulletin No. 19-03 and should be considered in assessing the results of our audits.

Alexandria, Virginia
November 14, 2019

KEARNEY& COMPANY

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INDEPENDENT AUDITOR'S REPORT ON INTERNAL CONTROL OVER FINANCIAL REPORTING

To the Director and Inspector General of the National Science Foundation

We have audited, in accordance with auditing standards generally accepted in the United States of America; the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States; and Office of Management and Budget (OMB) Bulletin No. 19-03, *Audit Requirements for Federal Financial Statements*, the financial statements of the National Science Foundation (NSF) as of and for the year ended September 30, 2019, and the related notes to the financial statements, which collectively comprise NSF's financial statements, and we have issued our report thereon dated November 14, 2019.

Internal Control over Financial Reporting

In planning and performing our audit of the financial statements, we considered NSF's internal control over financial reporting (internal control) to determine the audit procedures that are appropriate in the circumstances for the purpose of expressing our opinions on the financial statements, but not for the purpose of expressing an opinion on the effectiveness of NSF's internal control. Accordingly, we do not express an opinion on the effectiveness of NSF's internal control. We limited our internal control testing to those controls necessary to achieve the objectives described in OMB Bulletin No. 19-03. We did not test all internal controls relevant to operating objectives as broadly defined by the Federal Managers' Financial Integrity Act of 1982 (FMFIA), such as those controls relevant to ensuring efficient operations.

A deficiency in internal control exists when the design or operation of a control does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct, misstatements on a timely basis. A material weakness is a deficiency, or combination of deficiencies, in internal control, such that there is a reasonable possibility that a material misstatement of the entity's financial statements will not be prevented, or detected and corrected, on a timely basis. A significant deficiency is a deficiency, or combination of deficiencies, in internal control that is less severe than a material weakness, yet important enough to merit attention by those charged with governance.

Our consideration of internal control was for the limited purpose described in the first paragraph of this section and was not designed to identify all deficiencies in internal control that might be material weaknesses or significant deficiencies. Given these limitations, during our audit, we did not identify any deficiencies in internal control that we consider to be material weaknesses. However, material weaknesses may exist that have not been identified.

We noted certain additional matters involving internal control over financial reporting that we will report to NSF's management in a separate letter.

KEARNEY& COMPANY

Status of Prior Year Findings

In the *Independent Auditor's Report on Internal Control over Financial Reporting* within the audit report on NSF's fiscal year (FY) 2018 financial statements, we did not identify any issues related to internal control over financial reporting.

Purpose of this Report

The purpose of this report is solely to describe the scope of our testing of internal control and the results of that testing, and not to provide an opinion on the effectiveness of NSF's internal control. This report is an integral part of an audit performed in accordance with *Government Auditing Standards* and OMB Bulletin No. 19-03 in considering the entity's internal control. Accordingly, this communication is not suitable for any other purpose.

Alexandria, Virginia
November 14, 2019

KEARNEY& COMPANY

Attachment I – National Science Foundation's Management Response

OFFICE OF BUDGET, FINANCE & AWARD MANAGEMENT

MEMORANDUM

Date: NOV 14 2019

To: Allison Lerner, Inspector General

From: Teresa Grancorvitz, Chief Financial Officer

Subject: Management's Response to Independent Auditor's Report for Fiscal Year (FY) 2019

Thank you for the Independent Public Auditor's Report on the National Science Foundation's (NSF) FY 2019 financial statements. NSF's achievement of an unmodified opinion on its financial statements reflects the Agency's long-time record of collaboration with your office and the auditors.

Communication is the cornerstone of a high functioning relationship between the Office of the Chief Financial Officer, Office of Inspector General (OIG), and Kearney & Company. I am proud the groundwork we have laid out for an effective working relationship helped us overcome the emergent issues we encountered during this year's audit. I also appreciate the high integrity of work and collaboration the NSF staff, OIG, and Kearney & Company demonstrated.

We will continue to work with the OIG and Kearney & Company to maintain the accuracy in our systems, business processes, and timeliness of financial reporting, while recognizing the need for continuous improvements. If you have any questions or require additional information, please contact Mike Wetklow, Deputy Chief Financial Officer and Division Director for Financial Management at mwetklow@nsf.gov.

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INDEPENDENT AUDITOR'S REPORT ON COMPLIANCE WITH LAWS, REGULATIONS, CONTRACTS, AND GRANT AGREEMENTS

To the Director and Inspector General of the National Science Foundation

We have audited, in accordance with auditing standards generally accepted in the United States of America; the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States; and Office of Management and Budget (OMB) Bulletin No. 19-03, *Audit Requirements for Federal Financial Statements*, the financial statements of the National Science Foundation (NSF) as of and for the year ended September 30, 2019, and the related notes to the financial statements, which collectively comprise NSF's financial statements, and we have issued our report thereon dated November 14, 2019.

Compliance and Other Matters

As part of obtaining reasonable assurance about whether the NSF's financial statements are free from material misstatement, we performed tests of NSF's compliance with certain provisions of laws, regulations, contracts, and grant agreements, noncompliance with which could have a direct and material effect on the determination of financial statement amounts, as well as provisions referred to in Section 803(a) of the Federal Financial Management Improvement Act of 1996 (FFMIA). We limited our tests of compliance to these provisions and did not test compliance with all laws, regulations, contracts, and grant agreements applicable to NSF. However, providing an opinion on compliance with those provisions was not an objective of our audit, and accordingly, we do not express such an opinion. The results of our tests disclosed no instances of noncompliance or other matters that are required to be reported under *Government Auditing Standards* and OMB Bulletin No. 19-03.

The results of our tests of compliance with FFMIA disclosed no instances in which NSF's financial management systems did not comply substantially with the Federal financial management system's requirements, applicable Federal accounting standards, or application of the United States Standard General Ledger at the transaction level.

KEARNEY& COMPANY

Purpose of this Report

The purpose of this report is solely to describe the scope of our testing of compliance and the results of that testing, and not to provide an opinion on the effectiveness of the entity's compliance. This report is an integral part of an audit performed in accordance with *Government Auditing Standards* and OMB Bulletin No. 19-03 in considering the entity's compliance. Accordingly, this communication is not suitable for any other purpose.

Alexandria, Virginia
November 14, 2019

National Science Foundation

FINANCIAL STATEMENTS

As of and for the Fiscal Years ended
September 30, 2019 and 2018

National Science Foundation
Balance Sheet
As of September 30, 2019 and 2018
(Amounts in Thousands)

Assets	**2019**	**2018**
Intragovernmental Assets		
Fund Balance With Treasury (Note 2)	$ 14,897,841	$ 13,979,579
Accounts Receivable	7,213	14,195
Advances to Others	38,613	47,674
Total Intragovernmental Assets	14,943,667	14,041,448
Cash and Other Monetary Assets (Note 2)	22,662	28,385
Accounts Receivable, Net	576	945
General Property, Plant and Equipment, Net (Note 3)	327,827	281,211
Total Assets	**$ 15,294,732**	**$ 14,351,989**
Liabilities		
Intragovernmental Liabilities		
Accounts Payable	$ 9,951	$ 7,794
Other Intragovernmental Liabilities	7,982	5,010
Total Intragovernmental Liabilities	17,933	12,804
Accounts Payable	65,184	47,799
Actuarial FECA Liability	1,389	1,265
Environmental and Disposal Liabilities (Note 6)	12,657	10,268
Accrued Grant Liabilities	413,128	393,365
Accrued Payroll and Other Liabilities	9,581	7,834
Accrued Annual Leave	21,433	19,235
Total Liabilities	**$ 541,305**	**$ 492,570**
Net Position		
Unexpended Appropriations - Other Funds	$ 13,812,440	$ 12,987,425
Cumulative Results of Operations - Other Funds	353,017	308,487
Cumulative Results of Operations - Dedicated Collections (Note 7)	587,970	563,507
Total Net Position	**$ 14,753,427**	**$ 13,859,419**
Total Liabilities and Net Position	**$ 15,294,732**	**$ 14,351,989**

The accompanying notes are an integral part of these statements.

National Science Foundation
Statement of Net Cost
For the Years Ended September 30, 2019 and 2018
(Amounts in Thousands)

Program Costs (Note 8)	**2019**	**2018**
Research and Related Activities		
Gross Costs	$ 6,224,198	$ 6,137,371
Less: Earned Revenue	(76,590)	(80,482)
Net Research and Related Activities	**6,147,608**	**6,056,889**
Education and Human Resources		
Gross Costs	$ 886,650	$ 827,570
Less: Earned Revenue	(7,041)	(4,925)
Net Education and Human Resources	**879,609**	**822,645**
Major Research Equipment and Facilities Construction		
Gross Costs	$ 127,841	$ 177,708
Less: Earned Revenue	-	-
Net Major Research Equipment and Facilities Construction	**127,841**	**177,708**
Donations and Dedicated Collections		
Gross Costs	$ 165,090	$ 174,564
Less: Earned Revenue	-	-
Net Donations and Dedicated Collections	**165,090**	**174,564**
Net Cost of Operations (Note 8)	**$ 7,320,148**	**$ 7,231,806**

The accompanying notes are an integral part of these statements.

National Science Foundation
Statement of Changes in Net Position
For the Year Ended September 30, 2019
(Amounts in Thousands)

		2019		
		Funds From Dedicated Collections (Note 7)	All Other Funds	Total
Unexpended Appropriations				
Beginning Balances	$	-	12,987,425	12,987,425
Budgetary Financing Sources				
Appropriations Received		-	8,075,000	8,075,000
Cancelled Authority Adjustments		-	(60,156)	(60,156)
Appropriations Used		-	(7,189,829)	(7,189,829)
Total Budgetary Financing Sources		**-**	**825,015**	**825,015**
Total Unexpended Appropriations	**$**	**-**	**13,812,440**	**13,812,440**
Cumulative Results of Operations				
Beginning Balances	**$**	563,507	308,487	871,994
Budgetary Financing Sources				
Appropriations Used		-	7,189,829	7,189,829
Non-exchange Revenue		-	131	131
Donations		-	32,227	32,227
Funds from Dedicated Collections Transferred In / (Out)		157,298	-	157,298
Other Financing Sources				
Imputed Financing From Costs Absorbed By Others		-	14,953	14,953
Other		-	(5,297)	(5,297)
Total Financing Sources		**157,298**	**7,231,843**	**7,389,141**
Net Cost of Operations (Note 8)		**(132,835)**	**(7,187,313)**	**(7,320,148)**
Cumulative Results of Operations	**$**	**587,970**	**353,017**	**940,987**
Net Position	**$**	**587,970**	**14,165,457**	**14,753,427**

The accompanying notes are an integral part of these statements.

National Science Foundation
Statement of Changes in Net Position
For the Year Ended September 30, 2018
(Amounts in Thousands)

	2018		
	Funds From Dedicated Collections (Note 7)	All Other Funds	Total
Unexpended Appropriations			
Beginning Balances	$ -	12,328,610	12,328,610
Budgetary Financing Sources			
Appropriations Received	-	7,783,656	7,783,656
Cancelled Authority Adjustments	-	(74,039)	(74,039)
Appropriations Used	-	(7,050,802)	(7,050,802)
Total Budgetary Financing Sources	**-**	**658,815**	**658,815**
Total Unexpended Appropriations	**$ -**	**12,987,425**	**12,987,425**
Cumulative Results of Operations			
Beginning Balances	**$** 533,394	325,069	858,463
Budgetary Financing Sources			
Appropriations Used	-	7,050,802	7,050,802
Non-exchange Revenue	-	55	55
Donations	-	28,223	28,223
Funds from Dedicated Collections Transferred In / (Out)	155,429	-	155,429
Other Financing Sources			
Imputed Financing From Costs Absorbed By Others	-	13,799	13,799
Other	-	(2,971)	(2,971)
Total Financing Sources	**155,429**	**7,089,908**	**7,245,337**
Net Cost of Operations (Note 8)	**(125,316)**	**(7,106,490)**	**(7,231,806)**
Cumulative Results of Operations	**$ 563,507**	**308,487**	**871,994**
Net Position	**$ 563,507**	**13,295,912**	**13,859,419**

The accompanying notes are an integral part of these statements.

National Science Foundation
Statement of Budgetary Resources
For the Years Ended September 30, 2019 and 2018
(Amounts in Thousands)

	2019	2018
Budgetary Resources		
Unobligated Balance from Prior Year Budget Authority, Net	$ 417,890	$ 402,816
Appropriations	8,264,651	7,967,360
Spending Authority from Offsetting Collections	105,117	89,692
Total Budgetary Resources (Note 10)	$ **8,787,658**	$ **8,459,868**
Status of Budgetary Resources		
New Obligations and Upward Adjustments (Note 10)	$ 8,449,543	$ 8,132,724
Unobligated Balance, End of Year		
Apportioned, Unexpired (Note 2)	145,862	142,749
Unapportioned, Unexpired (Note 2)	25,160	31,610
Unobligated Balance, Unexpired, End of Year	171,022	174,359
Unobligated Balance, Expired, End of Year (Note 2)	167,093	152,785
Total Unobligated Balance, End of Year	338,115	327,144
Total Status of Budgetary Resources	**$ 8,787,658**	**$ 8,459,868**
Net Outlays		
Net Outlays (Note 10)	$ 7,292,246	$ 7,197,800
Distributed Offsetting Receipts (Note 10)	(37,741)	(31,459)
Net Agency Outlays	**$ 7,254,505**	**$ 7,166,341**

The accompanying notes are an integral part of these statements.

NOTES TO THE PRINCIPAL FINANCIAL STATEMENTS

Note 1. Summary of Significant Accounting Policies

A. Reporting Entity

The National Science Foundation (NSF or "Foundation") is an independent federal agency created by the National Science Foundation Act of 1950, as amended (42 U.S.C. 1861-75). Its primary mission is to promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense. NSF initiates and supports scientific research and research fundamental to the engineering process and programs to strengthen the Nation's science and engineering potential. NSF also supports critical education programs in science, technology, engineering, and mathematics (STEM) fields, which help prepare future generations of scientists and engineers. NSF funds research and education in science and engineering by awarding grants and contracts to educational and research institutions throughout the United States and its territories. NSF, by law, cannot operate research facilities except in the polar regions. NSF enters into relationships through awards, to fund the research operations conducted by grantees. Information on NSF funding by institution can be found on the website.[1]

NSF is led by a presidentially-appointed, Senate confirmed, Director and the 25-member National Science Board (NSB), including the NSF Director. The NSB members represent a cross section of prominent leaders in science and engineering research and education, and are appointed by the President for 6-year terms. The NSF Director is an *ex officio* member of the Board. NSF has a total workforce of about 2,100 at its Alexandria, VA, headquarters, including the staff of the NSB Office and the Office of the Inspector General (OIG). The NSF workforce includes approximately 1,400 career employees, 200 rotator scientists from research institutions in temporary positions, and 450 contract workers. NSF provides the opportunity for scientists, engineers, and educators to join the Foundation as temporary program directors and advisors. These "rotators" provide input during the merit review process of proposals; provide insight for new directions in the fields of science, engineering, and education; and support cutting-edge interdisciplinary research. Rotators can come to NSF under multiple mechanisms. The largest numbers come on Intergovernmental Personnel Act assignments, or IPAs, and remain employees of their home institutions. NSF facilitates IPA assignments through grants to their institution as a reimbursement in whole or in part for salary and benefits, and that reimbursement is then paid by the institution to their employee. All rotators are subject to criminal conflict of interest statutes as well as the government-wide Standards of Ethical Conduct of Employees of the Executive Branch, which prohibit them from participating in NSF proposals and awards affecting themselves and their home organizations.

B. Basis of Presentation

These financial statements have been prepared to report the financial position and results of operations of NSF as required by the Chief Financial Officers Act of 1990, the Government Management Reform Act of 1994, the Reports Consolidation Act of 2000, and the Office of Management and Budget (OMB) Circular No. A-136, *Financial Reporting Requirements*, revised June 28, 2019. While the statements have been prepared from the books and records of NSF in accordance with United States Generally Accepted

[1] NSF Funding by Institution: https://www.fiscal.treasury.gov/reports-statements/

Accounting Principles (U.S. GAAP) for federal entities and the formats prescribed by OMB, the statements are in addition to the financial reports used to monitor and control budgetary resources, which are prepared from the same books and records.

C. Basis of Accounting

The accompanying financial statements have been prepared in accordance with U.S. GAAP for federal entities using the accrual method of accounting. Under the accrual method, revenues are recognized when earned, and expenses are recognized when a liability is incurred, without regard to receipt or payment of cash. The accompanying financial statements also include budgetary accounting transactions that ensure compliance with legal constraints and controls over the use of federal funds.

D. Revenues and Other Financing Sources

NSF receives the majority of its funding through appropriations contained in the Commerce, Justice, Science, and Related Agencies Appropriations Act. NSF receives annual, multi-year, and no-year appropriations that may be expended within statutory limits. NSF also receives funding via warrant from a receipt account for dedicated collections that is reported as H-1B Nonimmigrant Petitioner Account (H- 1B) funds. Additional amounts are obtained from reimbursements for services provided to other federal agencies as well as from receipts to the NSF Donations Account. NSF also receives interest earned on overdue receivables, which is subsequently returned to Treasury at the end of each fiscal year.

In FY 2019, the Science Appropriations Act, 2019 under Public Law 116-6, provided funding for NSF's appropriations. In addition, the Science Appropriations Act provided an administrative provision allowing NSF to transfer up to 5 percent of current year funding between appropriations, but no appropriation may be increased by more than 10 percent. Appropriations are recognized as a financing source at the time the related "funded" program or administrative expenditures are incurred. Appropriations are also recognized when used to purchase Property, Plant and Equipment (PP&E). Donations are recognized as revenues when funds are received. Revenues from reimbursable agreements are recognized when the services are provided and the related expenditures are incurred. Reimbursable agreements are mainly for grant administrative services provided by NSF on behalf of other federal agencies.

Under the general authority of the Foundation, NSF is authorized to accept and use both U.S. and foreign funds in the NSF Donations Account. In accordance with 42 U.S.C. 1862 Section 3 (a)(3), NSF has authority "to foster the interchange of scientific and engineering information among scientists and engineers in the United States and foreign countries" and in 42 U.S.C. 1870 Section 11 (f), NSF is authorized to receive and use funds donated by others. Donations may be received from foreign governments, private companies, academic institutions, non-profit foundations, and individuals. These funds must be donated without restriction other than that they be used in furtherance of one or more of the general purposes of the Foundation. Funds are made available for obligations as necessary to support NSF programs.

E. Fund Balance with Treasury and Cash and Other Monetary Assets

Fund Balance with Treasury (FBWT) is composed of appropriated funds that are available to pay current liabilities and finance authorized purchase commitments. *Cash and Other Monetary Assets* include non-appropriated funding sources from donations and undeposited collections. *Undeposited Collections* are funds received by NSF, but not remitted to Treasury prior to September 30. Cash receipts and disbursements are processed by Treasury.

F. Accounts Receivable

Accounts Receivable consist of amounts due from governmental agencies, private organizations, and individuals. Additionally, NSF has the right to conduct audits on awardees to verify billed amounts. These audits may result in monies owed back to NSF. Upon resolution of the amount owed by the awardee to NSF, a receivable is recorded.

NSF establishes an allowance for loss on accounts receivable from non-federal sources that are deemed uncollectible but regards amounts due from other federal agencies as fully collectible. NSF analyzes each account independently to assess collectability and the need for an offsetting allowance or write-off. NSF writes off delinquent debt from non-federal sources that is more than 2 years old.

G. Advances to Others

Advances to Others consist of advances to federal agencies which are issued when agencies are operating under working capital funds or are unable to incur costs on a reimbursable basis. Advances are reduced when documentation supporting expenditures is received. Additionally, some NSF grantees receive advanced funds prior to incurring expenses. Payments are only made within the amount of the recorded grant obligation and are intended to cover immediate cash needs.

H. General Property, Plant and Equipment, Net

NSF capitalizes PP&E with costs exceeding $25.0 thousand and useful lives of 2 or more years; items not meeting these criteria are recorded as operating expenses. NSF currently reports capitalized PP&E at original acquisition cost; assets acquired from the General Services Administration (GSA) excess property schedules are recorded at the value assigned by the donating agency; and assets transferred in from other agencies are valued at the cost recorded by the transferring entity for the asset net of accumulated depreciation or amortization.

The PP&E balance consists of Equipment, Aircraft and Satellites, Buildings and Structures, Leasehold Improvements, Construction in Progress, Internal Use Software, and Software in Development. These balances are comprised of PP&E maintained “in-house” by NSF to support operations and PP&E under the U.S. Antarctic Program (USAP). The majority of USAP property is under the custodial responsibility of the NSF prime contractor for the program. The USAP is undergoing a multi-year modernization project initiated in FY 2019.

Depreciation expense is calculated using the straight-line half-year convention. The economic useful life classifications for capitalized assets are as follows:

Equipment

5 years	Computers and peripheral equipment, fuel storage tanks, laboratory equipment, and vehicles
7 years	Communications equipment, office furniture and equipment, pumps and compressors
10 or 15 years	Generators, Department of Defense equipment
20 years	Movable buildings (e.g., trailers)

Aircraft and Satellites

7 years	Aircraft, aircraft conversions, and satellites

Buildings and Structures

31.5 years	Buildings and structures placed in service prior to 1994
39 years	Buildings and structures placed in service after 1993

Leasehold Improvements

NSF's headquarters are leased through GSA under an occupancy agreement that is non-cancelable. Leasehold improvements performed by GSA are financed with NSF appropriated funds. Amortization is calculated using the straight-line half-year convention upon transfer from construction in progress.

Construction in Progress

Costs incurred for construction projects are accumulated and tracked as construction in progress until the asset is placed in service. Beneficial Occupancy is the point in time when the facility is ready for safe occupancy and use by NSF. Items that pertain to the safety and health of any future occupants of the facility must be corrected before a Beneficial Occupancy is granted and the facility occupied. All construction efforts at the construction site may not be completed (e.g., punch list items or other minor construction activities may still be required for construction to be considered complete), but the facility space can be used for its intended purpose. When Beneficial Occupancy is granted, the project is transferred from construction in progress to real property and depreciated over the respective useful life of the asset.

Internal Use Software and Software in Development

NSF controls, values, and reports purchased or developed software as tangible property assets, in accordance with the Statement of Federal Financial Accounting Standards (SFFAS) No. 10, *Accounting for Internal Use Software*. NSF identifies software investments as capital property for items that, in the aggregate, cost $500.0 thousand or more to purchase, develop, enhance, or modify a new or existing NSF system, or configure a government-wide system for NSF needs. Software projects that are not completed at year end and are expected to exceed the capitalization threshold are recorded as software in development. All internal use software meeting the capitalization threshold is amortized over a 5-year period using the straight-line half-year convention.

Assets Owned by NSF in the Custody of Other Entities: NSF awards grants, cooperative agreements, and contracts to various organizations, including colleges and universities, non-profit organizations, state and local governments, Federally Funded Research and Development Centers (FFRDCs), and private entities. The funds provided may be used in certain cases to purchase or construct PP&E to be used for operations or research on projects or programs sponsored by NSF. In these instances, NSF funds the acquisition of property, but transfers control of the assets to these entities. NSF's authorizing legislation specifically prohibits the Foundation from operating such property directly.

In practice, NSF's ownership interest in such PP&E is similar to a reversionary interest. To address the accounting and reporting of these assets, specific guidance was sought by NSF and provided by the Federal Accounting Standards Advisory Board (FASAB). This guidance stipulates that NSF should: (i) disclose the value of such PP&E held by others in its financial statements based on information contained in the audited financial statements of these entities (if available); and (ii) report information on costs incurred to acquire the research facilities, equipment, and platforms in the Research and Human Capital Activity costs as required by SFFAS No. 8, *Supplementary Stewardship Reporting*. Very few entities disclose information on NSF-owned property in their audited financial statements. Entities that separately present the book value of NSF-owned property in their audited financial statements are listed in Note 4, *General Property, Plant and Equipment in the Custody of Other Entities*, along with the book value of the property held.

I. Other Intragovernmental Liabilities

Other Intragovernmental Liabilities consist primarily of federal payroll payables, unfunded employment related liabilities, advances from others, and liabilities for non-entity assets. Liabilities for federal payroll payables consist of the federal portion of payroll benefits, taxes, and unfunded Federal Employees' Compensation Act (FECA) liabilities. *Advances From Others* consist of amounts obligated and advanced by other federal entities to NSF for grant administration and other services to be furnished under reimbursable agreements. Liabilities for non-entity assets are recorded to offset accounts receivable balances associated with canceled appropriations.

J. Liabilities Not Covered by Budgetary Resources

Liabilities not covered by budgetary resources may include future environmental cleanup liabilities, legal claims, pensions and other retirement benefits, workers' compensation, rental credit liability, and unfunded annual leave.

NSF cannot pay for liabilities unless authorized by law and covered by budgetary resources. Liabilities covered by budgetary resources are those for which appropriated funds are available as of the Balance Sheet date and include: new budget authority, unobligated balances of budgetary resources, spending authority from offsetting collections, and recoveries of budget authority through downward adjustments of prior year obligations.

K. Accounts Payable

Accounts Payable consist of liabilities to commercial vendors, contractors, federal agencies, and disbursements in transit. *Accounts Payable* are expenses for goods and services received but not yet paid for by NSF. At year end, NSF accrues for the amount of estimated unpaid expenses to vendors, contractors, and federal agencies for which invoices have not been received, but goods and services have been delivered and rendered.

L. Accrued Grant Liabilities

Accrued Grant Liabilities consist of estimated liabilities to grantees for expenses incurred but not reported (IBNR) by September 30. NSF's grant accrual methodology utilizes a linear regression model based on the statistical correlation between prior year unliquidated obligations and prior year expenses IBNR. NSF utilizes the Award Cash Management Service (ACM$), a grantee cash request and expenditure reporting system. ACM$ enables all grantee institutions to request funds at the award level to support project needs.

M. Accrued Payroll and Other Liabilities

Accrued Payroll and Other Liabilities consist of accrued payroll and undeposited collections. NSF's payroll services are provided by the Department of the Interior's Business Center. *Accrued Payroll* relates to services performed by NSF employees, for which they have not yet been paid. NSF accrues the amount of salaries and benefits earned, but not yet paid. At year end, NSF also records *Undeposited Collections* which are funds received by NSF, but not remitted to Treasury prior to September 30.

N. Employee Benefits

A liability is recorded for actual and estimated future payments to be made for workers' compensation pursuant to the FECA. The actual costs incurred are reflected as a liability because NSF will reimburse the U.S. Department of Labor (DOL) 2 years after the actual payment of expenses. The estimated actuarial FECA liability consists of the net present value of estimated future payments calculated by the DOL and is recorded as an unfunded liability. Future NSF Agency Operations and Award Management (AOAM) appropriations will be used for DOL's estimated reimbursement.

Annual leave is accrued as it is earned, and the accrual is reduced as leave is taken. Each quarter, the balance in the accrued annual leave account is adjusted to reflect changes. To the extent current and prior-year appropriations are not available to fund annual leave earned but not taken, funding will be obtained from future AOAM appropriations. Sick leave and other types of non-vested leave are expensed as taken.

O. Net Position

Net Position is the residual difference between assets and liabilities and is composed of unexpended appropriations and cumulative results of operations. *Unexpended Appropriations* represent the amount of undelivered orders and unobligated balances of budget authority. Unobligated balances are the amount of appropriations or other authority remaining after deducting the cumulative obligations from the amount available for obligation. The *Cumulative Results of Operations* represent the net results of NSF's operations since the Foundation's inception.

P. Retirement Plan

In FY 2019, approximately 4 percent of NSF employees participated in the Civil Service Retirement System (CSRS), to which NSF matches contributions equal to 7 percent of pay. The majority of NSF employees are covered by the Federal Employees Retirement System (FERS) and Social Security. A primary feature of FERS is the thrift savings plan to which NSF automatically contributes 1 percent of pay. The maximum NSF matching contribution is 5 percent of employee pay, of which 3 percent is fully matched, and 2 percent is matched at 50 percent. NSF also contributes the employer's matching share for Social Security for FERS participants.

Although NSF funds a portion of the benefits under FERS and CSRS relating to its employees and withholds the necessary payroll deductions, the Foundation has no liability for future payments to employees under these plans, nor does NSF report CSRS, FERS, Social Security assets, or accumulated plan benefits on its financial statements. Reporting such amounts is the responsibility of the Office of Personnel Management (OPM) and the Federal Retirement Thrift Investment Board.

SFFAS No. 5, *Accounting for Liabilities of the Federal Government*, requires employing agencies to recognize the cost of pensions and other retirement benefits during their employees' active years of service. OPM actuaries determine pension cost factors by calculating the value of pension benefits expected to be paid in the future, and provide these factors to the agency for current period expense reporting. Information is also provided by OPM regarding the full cost of health and life insurance benefits on the OPM Benefit Administration website.[2]

[2] OPM Benefit Administration website:
https://www.opm.gov/retirement-services/publications-forms/benefits-administration-letters/2019/19-101.pdf

Q. Contingencies and Possible Future Costs

Contingencies - Claims and Lawsuits: NSF is a party to various legal actions and claims brought against it. In the opinion of NSF management and legal counsel, the ultimate resolution of these actions and claims will not materially affect the financial position or operations of the Foundation. NSF recognizes the contingency in the financial statements when claims are expected to result in a material loss (and the payment amounts can be reasonably estimated), whether from NSF's appropriations or the Judgment Fund, administered by the Department of Justice under Section 1304 of Title 31 of the United States Code.

Claims and lawsuits can also be made and filed against awardees of the Foundation by third parties. NSF is not a party to these actions and NSF believes there is no possibility that NSF will be legally required to satisfy such claims. Judgments or settlements of the claims against awardees that impose financial obligation on them may be claimed as costs under the applicable contract, grant, or cooperative agreement and thus may affect the allocation of program funds in future fiscal years. In the event that the claim becomes probable and amounts can be reasonably estimated, the claim will be recognized.

Contingencies – Unasserted Claims: For claims and lawsuits that have not been made and filed against the Foundation, NSF management and legal counsel determine, in their opinion, whether resolution of the actions and claims they are aware of will materially affect the Foundation's financial position or operations. NSF recognizes a contingency in the financial statements if unasserted claims are probable of assertion, and if asserted, would be probable of an unfavorable outcome and expected to result in a measurable loss, whether from NSF's appropriations or the Judgment Fund. NSF discloses unasserted claims if the loss is more likely than not to occur, but the materiality of a potential loss cannot be determined.

Termination Claims: NSF engages organizations, including FFRDCs, in cooperative agreements and contracts to manage, operate, and maintain research facilities for the benefit of the scientific community. As part of these agreements and contracts, NSF funds on a pay-as-you-go basis certain employee benefit costs (accrued vacation and other employee related liabilities, severance pay and medical insurance), long-term leases, and vessel usage and drilling. In some instances, an award decision is made to continue operation of a facility with a different entity performing operation and management duties. In such an occurrence, NSF does not classify the facility as terminated. Claims submitted by the previous managing entity for expenditures not covered by the indirect cost rate included in the initial award are subject to audit and typically paid with existing program funds.

Agreements with FFRDCs include a clause that commits NSF to seek appropriations for termination expenses, if necessary, in the event a facility is terminated. NSF considers termination of these facilities only remotely possible. Should a facility be terminated, NSF is obligated to seek termination expenses for FFRDCs in excess of the limitation of funds set forth in the agreements, including any Post-Retirement Benefit liabilities, from Congress. Nothing in these agreements can be construed as implying that Congress will appropriate funds to meet the terms of any claims. Termination costs that may be payable to an FFRDC operator cannot be estimated until such time as the facility is terminated.

Environmental and Disposal Liabilities: NSF assesses the likelihood of required cleanup and establishes its environmental liability estimates in accordance with the requirements of the SFFAS No. 5, *Accounting for Liabilities of the Federal Government*, and as amended by SFFAS No. 12, *Recognition of Contingent Liabilities Arising from Litigation*, and the Federal Financial Accounting and Auditing Technical Release

No. 2, *Determining Probable and Reasonably Estimable for Environmental Liabilities in the Federal Government*.

Special attention is paid to USAP to ensure compliance with the Antarctic Conservation Act requirements for environmental cleanup in Antarctica. NSF continually monitors USAP in regards to environmental issues. While NSF is not legally liable for environmental cleanup costs in the Antarctic, there are occasions when the NSF Office of Polar Programs chooses to accept responsibility and commit funds toward cleanup efforts of various sites as resources permit. Decisions to commit funds are in no way driven by concerns of probable legal liability for failure to engage in such efforts, but rather a commitment to environmental stewardship of Antarctic natural resources. Environmental cleanup projects started and completed during the year are reflected in NSF's financial statements as expenses for the current fiscal year. An estimated cost would be accrued for approved projects that are anticipated to be performed after the fiscal year end or will take more than one fiscal year to complete.

R. Use of Estimates

Management has made certain estimates and assumptions when reporting assets, liabilities, revenues, and expenses, and also in the note disclosures. Estimates underlying the accompanying financial statements include accounting for grant liabilities, accounts payable, environmental liabilities, payroll, and PP&E. Actual results may differ from these estimates, and the difference will be adjusted for and included in the financial statements of the following fiscal year.

S. Permanent Indefinite Appropriations

NSF maintains permanent indefinite appropriations for Research and Related Activities (R&RA), Education and Human Resources (EHR), and Major Research Equipment and Facilities Construction (MREFC). The R&RA appropriation is used for polar research and operations support, and for reimbursement to other federal agencies for operational and science support, and logistical and other related activities for USAP. The EHR appropriation is used to support science and engineering education, and human resources programs and activities. The MREFC appropriation supports the procurement and construction of unique national research platforms, major research equipment, and USAP modernization projects.

T. Classified Activities

Accounting Standards require all reporting entities to disclose that accounting standards allow certain presentations and disclosures to be modified, if needed, to prevent the disclosure of classified information.

Note 2. Fund Balance with Treasury

Fund Balance with Treasury (FBWT) consisted of the following components as of September 30, 2019 and 2018:

(Amounts in Thousands)	2019 Total
Obligated	$ 14,582,018
Unobligated Available, Unexpired	145,862
Unobligated Unavailable, Unexpired	25,160
Unobligated Unavailable, Expired	167,093
Less: Cash and Other Monetary Assets	(22,662)
Add: Undeposited Collections and Donations Sequestration	370
Total FBWT	$ 14,897,841

(Amounts in Thousands)	2018 Total
Obligated	$ 13,680,740
Unobligated Available, Unexpired	142,749
Unobligated Unavailable, Unexpired	31,610
Unobligated Unavailable, Expired	152,785
Less: Cash and Other Monetary Assets	(28,385)
Add: Undeposited Collections and Donations Sequestration	80
Total FBWT	$ 13,979,579

Unobligated Available balances include current-period amounts available for obligation or commitment. *Unobligated Unavailable* balances include recoveries of prior year obligations and other unobligated expired funds that are unavailable for new obligations. Donations are reported as *Cash and Other Monetary Assets* and represent cash held outside of Treasury at a commercial bank in interest bearing accounts and may be subject to sequestration. *Undeposited Collections* are funds received by NSF, but not remitted to Treasury prior to September 30.

Note 3. General Property, Plant and Equipment, Net

The components of *General Property, Plant and Equipment, Net* as of September 30, 2019 and 2018 are shown below. As of September 30, 2019, NSF had not identified any asset impairments.

(Amounts in Thousands)	2019		
	Acquisition Cost	Accumulated Depreciation	Net Book Value
Equipment	$ 159,298	$ (146,869)	$ 12,429
Aircraft and Satellites	115,806	(115,806)	-
Buildings and Structures	315,080	(163,244)	151,836
Leasehold Improvements	29,569	(4,841)	24,728
Construction in Progress	57,391	-	57,391
Internal Use Software	88,295	(82,676)	5,619
Software in Development	75,824	-	75,824
Total PP&E	$ 841,263	$ (513,436)	$ 327,827

(Amounts in Thousands)	2018		
	Acquisition Cost	Accumulated Depreciation	Net Book Value
Equipment	$ 163,691	$ (149,343)	$ 14,348
Aircraft and Satellites	115,806	(115,806)	-
Buildings and Structures	315,005	(155,154)	159,851
Leasehold Improvements	29,389	(2,869)	26,520
Construction in Progress	6,439	-	6,439
Internal Use Software	88,294	(74,394)	13,900
Software in Development	60,153	-	60,153
Total PP&E	$ 778,777	$ (497,566)	$ 281,211

Note 4. General Property, Plant and Equipment in the Custody of Other Entities

NSF received a ruling from FASAB on accounting for non-USAP PP&E owned by NSF but in the custody of and used by others (see Note 1H. *General Property, Plant and Equipment, Net*). The FASAB guidance requires PP&E in the custody of others be excluded from NSF PP&E as defined in the SFFAS No. 6, *Accounting for Property, Plant and Equipment*. NSF is required to disclose the dollar amount of PP&E held by others for any entity which separately discloses NSF property in the most recently issued audited financial statements of the organization holding the assets.

Large facilities with significant NSF property are required to disclose in their audited financial statements the value of NSF-owned property in their custody. With the exception of these large facilities, other entities which received NSF funding are not required to report NSF-owned property separately in their audited financial statements. The amount of PP&E owned by NSF but in the custody of an NSF awardee which is separately disclosed in the awardee's audited financial statements is identified in the table below.

(Amounts in Thousands)

Entities with Audited and Separately Reported NSF-Owned Equipment	Amount	Fiscal Year Ending
Association of Universities for Research in Astronomy, Inc. - AURA	$957,528	9/30/18
Incorporated Research Institutions for Seismology - IRIS	$809	6/30/18
National Radio Astronomy Observatory - AUI	$371,117	9/30/18
University of Alaska	$160,100	6/30/18
University Corporation for Atmospheric Research - UCAR	$218,837	9/30/18

Note 5. Leases

NSF currently has federal leases with GSA for office space in Denver, Colorado and warehouse space in Springfield, Virginia. These leases are cancelable and expire in 2028 and 2024, respectively. The cancellation clauses within the agreements allow NSF to terminate use with 120-day notice. These leases contain escalation clauses tied to operating expenses. In addition, both the Denver and Springfield leases contain a contingent rental based on re-appraised rental rates.

NSF also leases its current headquarters in Alexandria, VA under a federal operating lease with GSA. This lease is non-cancelable and active through 2032. In addition, this lease contains escalation clauses tied to operating expenses and taxes. The following is a schedule of future minimum lease payments for the NSF headquarters:

(Amounts in Thousands)

Fiscal Year	Building Operating Lease Amount
2020	$ 24,648
2021	24,762
2022	24,879
2023	25,001
2024	25,125
2025 through 2032	203,387
Total Minimum Non-Cancelable Lease Payments	$ 327,802

Note 6. Environmental and Disposal Liabilities

Restoration Projects

NSF recorded a total estimated liability for a known restoration project of $2.2M in FY 2019, resulting from the cleanup estimate for the decontamination and decommissioning of the Sondrestrom Research Facility, a geophysical observatory in Kangerlussuaq, Greenland. After an extensive evaluation process, NSF decided to no longer conduct scientific observations from that site and will proceed with actions to restore the location.

Asbestos

Pursuant to FASAB Technical Bulletin 2006-1, *Recognition and Measurement of Asbestos-Related Cleanup Costs*, federal entities are required to recognize a liability for federal property asbestos cleanup costs. Some NSF owned buildings and structures used to support USAP have been identified as having, or expecting to have, friable and non-friable asbestos containing material.

As required by SFFAS No. 6, *Accounting for Property, Plant and Equipment*, NSF works with the current USAP contractor through the Antarctic Support Contract (ASC) to determine the need for asbestos liability adjustments based on actual asbestos costs incurred on an annual basis. Actual asbestos remediation costs are submitted by the ASC and the asbestos liability is adjusted for the impact. Asbestos remediation costs were incurred as of September 30, 2019. During FY 2019, changes to NSF's estimated asbestos liability consisted of the impact of asbestos remediation and cost re-estimates, resulting in a net increase from $10.3 million in FY 2018 to $10.5 million in FY 2019.

Note 7. Funds from Dedicated Collections

In FY 1999, Title IV of the American Competitiveness and Workforce Improvement Act of 1998 (P.L. 105-277) established the H-1B Nonimmigrant Petitioner Account in the General Fund of the U.S. Treasury. Funding is established from fees collected for alien, nonimmigrant status petitions. This law requires that a prescribed percentage of the funds in the account be made available to NSF for the following activities:

- Computer Science, Engineering, and Mathematics Scholarship
- Grants for Mathematics, Engineering, or Science Enrichment Courses
- Systemic Reform Activities

The H-1B Nonimmigrant Petitioner fees are available to the Director of NSF until expended. The funds may be used for scholarships to low income students, or to carry out a direct or matching grant program to support private and/or public partnerships in K-12 education. The H-1B fund is set up as a permanent indefinite appropriation by NSF. These funds are described in the Budget of the United States Government (President's Budget). *Funds from Dedicated Collections* are accounted for in a separate Treasury Account Symbol (TAS), and the budgetary resources are recorded as *Funds from Dedicated Collections Transferred In / (Out)*. *Funds from Dedicated Collections* are reported in accordance with SFFAS No. 43, *Funds from Dedicated Collections: Amending Statement of Federal Financial Accounting Standards 27, Identifying and Reporting Earmarked Funds*. For the years ended September 30, 2019 and 2018, NSF was subject to H-1B sequestrations in the amount of $9.7 million and $10.3 million, respectively.

(Amounts in Thousands)	2019	2018
Balance Sheet as of September 30, 2019 and 2018		
Fund Balance With Treasury	$ 603,934	$ 579,176
Total Assets	603,934	579,176
Accounts Payable	121	48
Accrued Grant Liabilities	15,843	15,621
Total Liabilities	15,964	15,669
Cumulative Results of Operations	587,970	563,507
Total Liabilities and Net Position	$ 603,934	$ 579,176
Statement of Net Cost for the Years Ended September 30, 2019 and 2018		
Program Costs	$ 132,835	$ 125,316
Net Cost of Operations	$ 132,835	$ 125,316
Statement of Changes in Net Position for the Years Ended September 30, 2019 and 2018		
Net Position Beginning of Period	$ 563,507	$ 533,394
Funds from Dedicated Collections Transferred In / (Out)	157,298	155,429
Net Cost of Operation	(132,835)	(125,316)
Change in Net Position	24,463	30,113
Net Position End of Period	$ 587,970	$ 563,507

Note 8. Statement of Net Cost

The Statement of Net Cost presents NSF's support for research and education awards as a single program with three primary appropriations: R&RA, EHR, and MREFC. *Donations and Dedicated Collections* are also presented in the Statement of Net Cost and in the tables below.

In pursuit of its mission, NSF incurs costs in line with the Foundation's strategic plan for 2018-2022: *Building the Future: Investing in Discovery and Innovation*. The Plan lays out three strategic goals. The first, "Expand knowledge in science, engineering, and learning," is aligned with the first part of NSF's mission, "to promote the progress of science." It aims to advance knowledge through investments in ideas, people, and infrastructure, and to advance the practice of research. The second strategic goal, "Advance the capability of the Nation to meet current and future challenges," flows from the latter part of the NSF mission statement—"to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." It focuses on societal impacts and the STEM workforce. The third goal, "Enhance NSF's performance of its mission," includes strategies to attract, retain, and empower a talented and diverse workforce, and to continually improve agency operations.

Stewardship costs directly reflect the third strategic goal, "Enhance NSF's performance of its mission", and are prorated among the Net Cost programs. Stewardship costs include expenditures incurred from the AOAM, NSB, and OIG appropriations. These appropriations support salaries and benefits of persons employed at NSF; general operating expenses, including support of NSF's information systems technology; staff training, audit and OIG activities; and OPM and DOL benefits costs paid on behalf of NSF.

As of September 30, 2019 and 2018, approximately 95 percent of NSF's expenses totaling to $7.1 billion and $6.9 billion, respectively, were directly related to the ''Expand Knowledge in science, engineering, and learning'' and ''Advance the capability of the Nation to meet current and future challenges'' strategic outcome goals. As of September 30, 2019 and 2018, costs related to the stewardship activities totaled $372.0 million and $395.0 million, respectively.

In accordance with OMB Circular No. A-136, costs incurred for services provided to other federal entities are reported in the full costs of NSF programs and are separately identified in this note as "Federal." Costs incurred with non-federal entities are identified in this note as "Public." Earned revenues from other federal entities are offsetting collections provided through reimbursable agreements and are retained by NSF. Earned revenues are recognized when the related program or administrative expenses are incurred and are deducted from the full cost of the programs to arrive at the net cost of operating NSF's programs. NSF applies a cost recovery fee on other federal entities consistent with applicable legislation and U.S. Government Accountability Office decisions. NSF recovers the costs incurred in the management, administration, and oversight of activities authorized and/or funded by interagency agreements where NSF is the performing agency.

Intragovernmental and Public Costs and Earned Revenue by Program

(Amounts in Thousands)	2019		
	Federal	Public	Total
Research and Related Activities			
Gross Costs	$ 265,421	$ 5,958,777	$ 6,224,198
Less: Earned Revenue	(71,761)	(4,829)	(76,590)
Net Research and Related Activities	193,660	5,953,948	6,147,608
Education and Human Resources			
Gross Costs	$ 8,989	$ 877,661	$ 886,650
Less: Earned Revenue	(6,597)	(444)	(7,041)
Net Education and Human Resources	2,392	877,217	879,609
Major Research Equipment and Facilities Construction			
Gross Costs	$ 449	$ 127,392	$ 127,841
Less: Earned Revenue	-	-	-
Net Major Research Equipment and Facilities Construction	449	127,392	127,841
Donations and Dedicated Collections			
Gross Costs	$ 132	$ 164,958	$ 165,090
Less: Earned Revenue	-	-	-
Net Donations and Dedicated Collections	132	164,958	165,090
Net Cost of Operations	$ 196,633	$ 7,123,515	$ 7,320,148

(Amounts in Thousands)	2018		
	Federal	Public	Total
Research and Related Activities			
Gross Costs	$ 219,903	$ 5,917,468	$ 6,137,371
Less: Earned Revenue	(78,476)	(2,006)	(80,482)
Net Research and Related Activities	141,427	5,915,462	6,056,889
Education and Human Resources			
Gross Costs	$ 13,311	$ 814,259	$ 827,570
Less: Earned Revenue	(4,802)	(123)	(4,925)
Net Education and Human Resources	8,509	814,136	822,645
Major Research Equipment and Facilities Construction			
Gross Costs	$ 128	$ 177,580	$ 177,708
Less: Earned Revenue	-	-	-
Net Major Research Equipment and Facilities Construction	128	177,580	177,708
Donations and Dedicated Collections			
Gross Costs	$ 219	$ 174,345	$ 174,564
Less: Earned Revenue	-	-	-
Net Donations and Dedicated Collections	219	174,345	174,564
Net Cost of Operations	$ 150,283	$ 7,081,523	$ 7,231,806

Note 9. Undelivered Orders at the End of the Year

In accordance with SFFAS No. 7, *Accounting for Revenue and Other Financing Sources*, the amount of budgetary resources obligated for undelivered orders for the years ended September 30, 2019 and 2018 amounted to $14.2 billion and $13.4 billion, respectively.

(Amounts in Thousands)	2019	2018
Undelivered Orders as of September 30, 2019 and 2018		
Undelivered Orders, Unpaid - Non-Federal	$ 14,035,172	$ 13,161,220
Undelivered Orders, Paid - Federal	39,010	47,752
Undelivered Orders, Unpaid - Federal	151,488	145,379
Total Undelivered Orders - Federal	190,498	193,131
Total Undelivered Orders	$ 14,225,670	$ 13,354,351

Note 10. Explanation of Differences between the Statement of Budgetary Resources and the Budget of the United States Government

SFFAS No. 7, *Accounting for Revenue and Other Financing Sources and Concepts for Reconciling Budgetary and Financial Accounting*, requires explanations of material differences between amounts reported in the SBR and the actual balances published in the President's Budget. The FY 2021 President's Budget will include FY 2019 budget execution information and is scheduled for publication in the spring of 2020 and can be found upon publication on the OMB website.[3]

Balances reported in the FY 2018 SBR and the related President's Budget are shown in a table below for Budgetary Resources, New Obligations and Upward Adjustments, Distributed Offsetting Receipt, and Net Outlays, and any related differences. The differences reported are due to differing reporting requirements for expired and unexpired appropriations between the Treasury guidance used to prepare the SBR and the OMB guidance used to prepare the President's Budget. The SBR includes both unexpired and expired appropriations, while the President's Budget presents only unexpired budgetary resources that are available for new obligations. Additionally, the Distributed Offsetting Receipts amount on the SBR includes donations, while the President's Budget does not.

(Amounts in Thousands)

Fiscal Year 2018	Budgetary Resources	New Obligations and Upward Adjustments	Distributed Offsetting Receipts	Net Outlays
Combined Statement of Budgetary Resources	$ 8,459,868	$ 8,132,724	$ 31,459	$ 7,197,800
Expired Accounts	$ (158,105)	$ (5,320)	$ -	$ -
Other	$ -	$ -	$ (28,459)	$ -
Budget of the U.S. Government	$ 8,301,763	$ 8,127,404	$ 3,000	$ 7,197,800

[3] OMB website: https://www.whitehouse.gov/omb

Note 11. Awards to Affiliated Institutions

NSB members may be affiliated with institutions that are eligible to receive grants and awards from NSF. NSF made awards totaling $983.2 million to Board member affiliated institutions as of September 30, 2019. The Board does not review all NSF award actions; however, the following require NSB approval for the NSF Director to take action under delegated authority:

- Proposed awards where the average annual award amount is the greater of one percent of the prior year current plan of the awarding directorate/office, or 0.1 percent of the prior year enacted NSF budget level;

- Major Research Equipment and Facilities Construction (MREFC) awards;

- Amendments to awards and procurement actions specifying a dollar amount in the Board resolution, if the amended award exceeds the lesser of $10.0 million dollars or 20 percent of the amount specified in the Board resolution; and

- In the case of procurements when no amount was specified in the Board resolution, if the amended amount exceeds the lesser of $10.0 million dollars or 20 percent of the contract ceiling award amount.

The Director will continue to consult with the NSB on programs which represent a significant, long-term investment, particularly those which will be funded as an ongoing NSF-wide activity or which involve substantive policy, interagency, or international issues.

The Director's Review Board (DRB) reviews proposed actions for evaluation adequacy and documentation, and compliance with Foundation policies, procedures and strategies. Items requiring DRB action include large awards and Requests for Proposal that meet or exceed a threshold of 2.5 percent of the prior year Division or Subactivity Plan. In addition, the DRB reviews all items requiring NSB action as well as NSB information items prior to submission.

NSF may fund awards meeting the above requirements to institutions affiliated with Board members. Federal conflict-of-interest rules prohibit NSB members from participating in matters where they have a conflict of interest or there is an impartiality concern without prior authorization from the Designated Agency Ethics Official (DAEO). Prior to Board meetings, all NSB action items are screened for conflict-of-interest/impartiality concerns by the Office of the General Counsel. Members who have conflicts are either recused from the matter or receive a waiver from the DAEO to participate. In FY 2019, NSB did not approve any awards to Board member affiliated institutions.

Note 12. Reconciliation of Net Cost to Net Outlays

OMB Circular No. A-136 prescribed a new disclosure for the reconciliation of net costs to net outlays to reflect the new FASAB standard, SFFAS No. 53, *Budget and Accrual Reconciliation*, effective for FY 2019 reporting. The note reconciles the net costs for a federal entity's programs and operations to the net outlays for that entity, and replaces the Reconciliation of Net Cost of Operations to Budget note.

	2019		
(Amounts in Thousands)	Federal	Public	Total
Net Cost	**$ 196,633**	**$ 7,123,515**	**$ 7,320,148**
Components of Net Cost Not Part of Net Outlays			
Property, Plant, and Equipment Depreciation	-	(23,757)	(23,757)
Other (Cost Capitalization Offset)	-	70,398	70,398
Increase/(Decrease) in Assets:			
Accounts Receivable	(6,982)	(370)	(7,352)
Other Assets	(9,061)	285	(8,776)
(Increase)/Decrease in Liabilities Not Affecting Net Outlays:			
Accounts Payable	(1,438)	(17,386)	(18,824)
Salaries and Benefits	(384)	(1,462)	(1,846)
Environmental and Disposal Liabilities	-	(2,389)	(2,389)
Other Liabilities (Grant, Rental Credit, Unfunded Leave, FECA, and Other Misc)	(3,306)	(22,370)	(25,676)
Other Financing Sources:			
Imputed Financing (OPM and DHS)	(14,953)	-	(14,953)
Total Components of Net Cost Not Part of the Net Outlays	**$ (36,124)**	**$ 2,949**	**$ (33,175)**
Components of Net Outlays Not Part of Net Cost			
Other (Revenue)	$ (110)	$ (32,358)	$ (32,468)
Total Components of Net Outlays Not Part of Net Cost	**$ (110)**	**$ (32,358)**	**$ (32,468)**
Net Outlays	**$ 160,399**	**$ 7,094,106**	**$ 7,254,505**
Related Amounts on the Statement of Budgetary Resources			
Net Outlays			$ 7,292,246
Distributed Offsetting Receipts			(37,741)
Net Agency Outlays			**$ 7,254,505**

Note 13. Reclassification Adjustments of Balance Sheet, Statement of Net Cost, and Statement of Changes in Net Position Due to FR Compilation

To prepare the Financial Report of the U.S. Government (FR), the Department of the Treasury requires agencies to submit an adjusted trial balance, which is a listing of amounts by U.S. Standard General Ledger account that appear in the financial statements. Treasury uses the trial balance information reported in the Governmentwide Treasury Account Symbol Adjusted Trial Balance System (GTAS) to develop a Reclassified Balance Sheet, Reclassified Statement of Net Cost, and a Reclassified Statement of Changes in Net Position for each agency, which are accessed using GTAS. Treasury eliminates all intragovernmental balances from the reclassified statements and aggregates lines with the same title to develop the FR statements. This note shows the National Science Foundation's financial statements and the National Science Foundation's reclassified statements prior to elimination of intragovernmental balances and prior to aggregation of repeated FR line items. A copy of the 2018 FR can be found and a copy of the 2019 FR will be posted to this site as soon as it is released.[4]

The term "non-Federal" is used in this note to refer to Federal Government amounts that result from transactions with non-Federal entities. These include transactions with individuals, businesses, non-profit entities, and State, local, and foreign governments.

[4] 2018 FR website: https://www.fiscal.treasury.gov/reports-statements/

Reclassification of Balance Sheet to Line Items Used for the Government-wide Balance Sheet as of September 30, 2019

FY 2019 National Science Foundation Balance Sheet		Line Items Used to Prepare FY 2019 Government- wide Balance Sheet	
Financial Statement Line	Amounts (in thousands)	Amounts (in thousands)	Reclassified Financial Statement Line
ASSETS			**ASSETS**
Intra-Governmental Assets			**Intra-Governmental Assets**
Fund Balance With Treasury	$ 14,897,841	14,897,841	Fund Balance With Treasury
Accounts Receivable	7,213	7,213	Accounts Receivable
Total Accounts Receivable	7,213	7,213	Total Accounts Receivable
Advances to Others	38,613	38,613	Advances to Others and Prepayments
Total Intra-Governmental Assets	14,943,667	14,943,667	Total Intra-Governmental Assets
Cash and Other Monetary Assets	22,662	22,662	Cash and Other Monetary Assets
Accounts Receivable, Net	576	576	Accounts and Taxes Receivable, Net
General Property, Plant, and Equipment, Net	327,827	327,827	Property, Plant, and Equipment, Net
TOTAL ASSETS	**$ 15,294,732**	**$ 15,294,732**	**TOTAL ASSETS**
LIABILITIES			**LIABILITIES**
Intra-Governmental Liabilities			**Intra-Governmental Liabilities**
Accounts Payable	$ 9,951	$ 13,241	Accounts Payable
Other Intragovernmental Liabilities	7,982	552	Liability to the General Fund for Custodial and Other Non-Entity Assets
		1,944	Benefit Program Contributions Payable
		2,196	Other Liabilities (Without Reciprocals)
Total Intra-Governmental Liabilities	17,933	17,933	Total Intra-Governmental Liabilities
Accounts Payable	65,184	65,184	Accounts Payable
Acturial FECA Liability	1,389	1,389	Total Federal Employee and Veteran Benefits Payable
Environmental and Disposal Liabilities	12,657	12,657	Environmental and Disposal Liabilities
Accrued Grant Liabilities	413,128	444,142	Other Liabilities
Accrued Payroll and Other Liabilities	9,581		
Accrued Annual Leave	21,433		
Total Miscellaneous Liabilities	444,142	444,142	Total Other Liabilities
TOTAL LIABILITIES	**$ 541,305**	**$ 541,305**	**TOTAL LIABILITIES**
NET POSITION			**NET POSITION**
Unexpended Appropriations – Other Funds	$ 13,812,440	$ 14,165,457	Net Position – Funds Other than those from Dedicated Collections
Cumulative Results of Operations – Other Funds	353,017		
Cumulative Results of Operations – Dedicated	587,970	587,970	Net Position – Funds from Dedicated Collections
TOTAL NET POSITION	**$ 14,753,427**	**$ 14,753,427**	**TOTAL NET POSITION**
TOTAL LIABILITIES & NET POSITION	**$ 15,294,732**	**$ 15,294,732**	**TOTAL LIABILITIES & NET POSITION**

Reclassification of Statement of Net Cost (SNC) to Line Items Used for the Government-wide SNC for the Year Ending September 30, 2019

FY 2019 National Science Foundation SNC		**Line Items Used to Prepare FY 2019 Government-wide SNC**	
Financial Statement Line	Amounts (in thousands)	Amounts (in thousands)	Reclassified Financial Statement Line
GROSS COSTS			**GROSS COSTS**
Research and Related Activities	$ 6,224,198	$ 7,128,787	Non-Federal Gross Cost
Education and Human Resources	886,650	35,775	Benefit Program Costs
Major Research Equipment and Facilities Construction	127,841	14,953	Imputed Costs
Donations and Dedicated Collections	165,090	211,516	Buy/Sell Costs
		12,748	Other Expenses (Without Reciprocals)
		274,992	Total Federal Gross Cost
TOTAL GROSS COSTS	**$ 7,403,779**	**$ 7,403,779**	**TOTAL GROSS COSTS**
EARNED REVENUE			**EARNED REVENUE**
Research and Related Activities	$ (76,590)	$ (5,273)	Non-Federal Earned Revenue
Education and Human Resources	(7,041)	(78,358)	Buy/Sell Revenue (Exchange)
		(78,358)	Total Federal Earned Revenue
TOTAL EARNED REVENUE	**$ (83,631)**	**$ (83,631)**	**TOTAL EARNED REVENUE**

Reclassification of Statement of Changes in Net Position (SCNP) to Line Items Used for the Government-wide Statement of Operations and Changes in Net Position for the Year Ending September 30, 2019

FY 2019 National Science Foundation SCNP		**Line Items Used to Prepare FY 2019 Government-wide SCNP**	
Financial Statement Line	Amounts (in thousands)	Amounts (in thousands)	Reclassified Financial Statement Line
UNEXPENDED APPROPRIATIONS			
Unexpended Appropriations, Beginning Balance	$ 12,987,425	$ 13,859,419	Net Position, Beginning of Period (Includes Cumulative Results of Operations, Beginning Balance)
Appropriations Received	8,075,000	8,014,844	Appropriations Received as Adjusted
Cancelled Authority Adjustments	(60,156)		
Appropriations Used	(7,189,829)	(7,189,829)	Appropriations Used
TOTAL UNEXPENDED APPROPRIATIONS	**13,812,440**		
CUMULATIVE RESULTS OF OPERATIONS			
Cumulative Results of Operations, Beginning Balance	$ 871,994	$ Included Above	Net Position, Beginning of Period (Included in Net Position, Unexpended Appropriations)
Appropriations Used	7,189,829	7,189,829	Appropriations Expended
Non-Exchange Revenue	131	32,334	Other Taxes and Receipts
Donations	32,227		
Other (1 of 2)	(24)		
Total Non-Exchange Revenues	32,334	32,334	Total Non-Federal Non-Exchange Revenues
		167,015	Appropriation of Unavailable Special/Trust Fund Receipts Transfers-In
		(9,717)	Appropriation of Unavailable Special/Trust Fund Receipts Transfers-Out
Funds from Dedicated Collections Transferred In / (Out)	157,298	157,298	Total Appropriation of Unavailable Special/Trust Fund Receipts Transfers-In
Imputed Financing	14,953	14,953	Imputed Financing Sources
		(5,383)	Non-Entity Collections Transferred to the General Fund
		110	Accrual for Non-Entity Amounts to be Collected and Transferred to the General Fund
Other (2 of 2)	(5,273)	(5,273)	Total Non-Entity Collections and Accrual for Non-Entity Amounts to be Collected
Total Financing Sources	**7,389,141**		
Net Cost of Operations	**(7,320,148)**	**(7,320,148)**	Net Cost of Operations
CUMULATIVE RESULTS OF OPERATIONS, ENDING BALANCE	**940,987**		
TOTAL NET POSITION	**$ 14,753,427**	**$ 14,753,427**	**TOTAL NET POSITION**

REQUIRED SUPPLEMENTARY STEWARDSHIP INFORMATION

Stewardship Investments

For the Fiscal Years ended September 30, 2019 and 2018

Stewardship Investments
Research and Human Capital
(Dollar Amounts in Thousands)

Research and Human Capital Activities

	2019	2018	2017	2016	2015
Basic Research	$ 5,464,153	$ 5,247,173	$ 5,213,706	$ 5,216,976	$ 5,202,144
Applied Research	816,299	862,049	820,635	793,519	782,986
Education and Training	751,578	813,076	821,413	775,326	801,678
Non-Investing Activities	371,749	394,915	364,024	371,217	329,685
Total Research & Human Capital Activities	$ 7,403,779	$ 7,317,213	$ 7,219,778	$ 7,157,038	$ 7,116,493

Inputs, Outputs and/or Outcomes

Research and Human Capital Activities

Investments In:					
Universities	$ 5,430,987	$ 5,290,399	$ 5,260,018	$ 5,289,267	$ 5,201,477
Industry	278,534	272,626	169,101	300,279	365,221
Federal Agencies	199,682	174,974	229,668	178,845	167,018
Small Business	272,290	286,220	292,997	240,759	225,958
Federally Funded R&D Centers	266,077	293,884	247,549	231,977	231,813
Non-Profit Organizations	418,756	494,364	529,241	446,750	451,232
Other	537,453	504,746	491,204	469,161	473,774
	$ 7,403,779	$ 7,317,213	$ 7,219,778	$ 7,157,038	$ 7,116,493
Support To:					
Scientists	$ 592,123	$ 623,889	$ 585,172	$ 595,743	$ 584,865
Postdoctoral Programs	203,048	208,136	200,840	195,874	203,128
Graduate Students	666,239	649,550	628,367	625,059	629,922
	$ 1,461,410	$ 1,481,575	$ 1,414,379	$ 1,416,676	$ 1,417,915
Outputs & Outcomes (Rounded):					
Number of:					
Award Actions	19,000	20,000	20,000	21,000	21,000
Senior Researchers	41,000	44,000	42,000	44,000	42,000
Other Professionals	12,000	14,000	14,000	14,000	14,000
Postdoctoral Associates	5,000	6,000	6,000	6,000	6,000
Graduate Students	42,000	42,000	41,000	41,000	42,000
Undergraduate Students	38,000	38,000	38,000	38,000	36,000
K-12 Students	125,000	200,000	172,000	170,000	172,000
K-12 Teachers	40,000	42,000	40,000	44,000	41,000

NSF's mission is to support basic scientific research and research fundamental to the engineering process as well as education programs in STEM fields. NSF's Stewardship Investments fall principally into the categories of Research and Human Capital. For expenses incurred under the Research category, the majority of NSF funding is devoted to basic research, with a relatively small share going to applied research. This funding supports both the conduct of research and the necessary supporting infrastructure, including state-of-the-art instrumentation, equipment, computing resources, aircraft, and multi-user facilities such as digital libraries, observatories, and research vessels. Basic research, applied research, and education and training expenses are determined by prorating the program costs of NSF's R&RA, EHR, and MREFC appropriations, donations, and funds from dedicated collections reported on the Statement of Net Cost. The proration uses the basic research, applied research, and education and training percentages of total prior year research and development obligations reported in the FY 2020 Budget Request to Congress. The actual numbers are not available until later in the following fiscal year. Non-Investing activities reflect stewardship costs incurred from the AOAM, NSB, and OIG appropriations.

The data provided for scientists, postdoctoral associates, and graduate students are obtained from NSF's award budget information as recorded at the time the award is made. The number of award actions are actual values from NSF's Enterprise Information System (EIS). The remaining outputs and outcomes are estimates provided annually by the NSF Directorates. These estimates are reported in the annual NSF Budget Request to Congress.

NSF's Human Capital investments focus principally on education and training toward a goal of creating a diverse, internationally competitive, and globally engaged workforce of scientists, engineers and well-prepared citizens. NSF supports activities to improve formal and informal science, mathematics, engineering and technology education at all levels, as well as public science literacy projects that engage people of all ages in life-long learning. The number of K-12 students and teachers involved in NSF activities is based on a robust data collection and analysis process. Changes to NSF's support of K-12 students in FY 2019 is the result of changes to Established Program to Stimulate Competitive Research (EPSCoR) eligible jurisdictions compared to FY 2018. The reported number of K-12 students and teachers in FY 2019 excludes data from EPSCoR programs' investments in South Dakota. Reporting from this jurisdiction is expected to be final by December 2019 and will be reflected in the FY 2021 Budget Request to Congress.

REQUIRED SUPPLEMENTARY INFORMATION

Deferred Maintenance and Repairs

For the Fiscal Years ended September 30, 2019 and 2018

Deferred Maintenance and Repairs

NSF performs condition assessment surveys in accordance with SFFAS No. 42, *Deferred Maintenance and Repairs*, for capitalized general PP&E, including fully depreciated general personal property to determine if any maintenance and repairs are needed to keep an asset in an acceptable condition or restore an asset to a specific level of performance. NSF considers deferred maintenance and repairs to be any maintenance and repairs that are not performed on schedule, unless it is determined from the condition of the asset that scheduled maintenance does not have to be performed. Deferred maintenance and repairs also include any other type of maintenance or repair that, if not performed, would render the PP&E non-operational. Circumstances such as non-availability of parts or funding are considered reasons for deferring maintenance and repairs.

NSF considered whether any scheduled maintenance or repair necessary to keep fixed assets of the agency in an acceptable condition was deferred at fiscal years ended September 30, 2019 and 2018. Assets deemed to be in excellent, good, or fair condition are considered to be in acceptable condition. Assets in poor or very poor condition are in unacceptable condition and the deferred maintenance and repairs required to get them to an acceptable condition are reported. NSF determines the condition of an asset in accordance with standards comparable to those used in the private industry. Due to the environment and remote location of Antarctica, all deferred maintenance and repairs on assets in poor or very poor condition are considered critical in order to maintain operational status.

In accordance with SFFAS No. 42, NSF discloses the beginning and ending balances for the fiscal year ending September 30, 2019. At September 30, 2019 and 2018, NSF determined that there was no scheduled maintenance or repairs on Antarctic capital equipment in poor or very poor condition that were not completed and were deferred or delayed for a future period.

REQUIRED SUPPLEMENTARY INFORMATION

Combining Statement of Budgetary Resources by Major Budget Accounts

In the following tables, NSF budgetary information for the fiscal years ended September 30, 2019 and 2018, as presented in the Statement of Budgetary Resources, is disaggregated for each of NSF's major budget accounts.

The Science Appropriations Act, 2019
2019
(Amounts in Thousands)

	Research and Related Activities	Education and Human Resources	Major Research Equipment	OIG, AOAM, and NSB	Special and Donated	Total
Budgetary Resources						
Unobligated Balance from Prior Year Budget Authority, Net	$ 224,099	55,516	28,486	8,815	100,974	417,890
Appropriations	6,504,510	922,000	295,740	352,750	189,651	8,264,651
Spending Authority from Offsetting Collections	92,992	5,344	-	6,781	-	105,117
Total Budgetary Resources	$ **6,821,601**	**982,860**	**324,226**	**368,346**	**290,625**	**8,787,658**
Status of Budgetary Resources						
New Obligations and Upward Adjustments	$ 6,675,953	940,342	285,273	359,932	188,043	8,449,543
Unobligated Balance, End of Year:						
Apportioned, Unexpired	20,505	5,537	38,897	1,050	79,873	145,862
Unapportioned, Unexpired	1,310	1,081	56	4	22,709	25,160
Unobligated Balance, Unexpired, End of Year	21,815	6,618	38,953	1,054	102,582	171,022
Unobligated Balance, Expired, End of Year	123,833	35,900	-	7,360	-	167,093
Total Unobligated Balance, End of Year	145,648	42,518	38,953	8,414	102,582	338,115
Total Status of Budgetary Resources	$ **6,821,601**	**982,860**	**324,226**	**368,346**	**290,625**	**8,787,658**
Net Outlays						
Net Outlays	$ 5,808,697	837,740	139,085	348,520	158,204	7,292,246
Distributed Offsetting Receipts	-	-	-	-	(37,741)	(37,741)
Net Agency Outlays	**$ 5,808,697**	**837,740**	**139,085**	**348,520**	**120,463**	**7,254,505**

The Science Appropriations Act and Bipartisan Budget Act, 2018
2018
(Amounts in Thousands)

		Research and Related Activities	Education and Human Resources	Major Research Equipment	OIG, AOAM, and NSB	Special and Donated	Total
Budgetary Resources							
Unobligated Balance from Prior Year Budget Authority, Net	$	174,361	51,536	31,928	10,780	134,211	402,816
Appropriations		6,350,776	902,000	182,800	348,080	183,704	7,967,360
Spending Authority from Offsetting Collections		79,313	4,552	-	5,827	-	89,692
Total Budgetary Resources	$	**6,604,450**	**958,088**	**214,728**	**364,687**	**317,915**	**8,459,868**
Status of Budgetary Resources							
New Obligations and Upward Adjustments	$	6,461,184	909,038	186,298	354,730	221,474	8,132,724
Unobligated Balance, End of Year:							
Apportioned, Unexpired		28,015	6,877	27,863	1,004	78,990	142,749
Unapportioned, Unexpired		5,348	8,181	567	63	17,451	31,610
Unobligated Balance, Unexpired, End of Year		33,363	15,058	28,430	1,067	96,441	174,359
Unobligated Balance, Expired, End of Year		109,903	33,992	-	8,890	-	152,785
Total Unobligated Balance, End of Year		143,266	49,050	28,430	9,957	96,441	327,144
Total Status of Budgetary Resources	$	**6,604,450**	**958,088**	**214,728**	**364,687**	**317,915**	**8,459,868**
Net Outlays							
Net Outlays	$	5,691,371	783,915	170,321	385,900	166,293	7,197,800
Distributed Offsetting Receipts		-	-	-	-	(31,459)	(31,459)
Net Agency Outlays	**$**	**5,691,371**	**783,915**	**170,321**	**385,900**	**134,834**	**7,166,341**

Chapter 3

Appendices (Other Information)

SUMMARY OF FY 2019 FINANCIAL STATEMENT AUDIT AND MANAGEMENT ASSURANCES

Table 3.1 – Summary of Financial Statement Audit

Audit Summary					
Audit Opinion	*Unmodified*				
Restatement	*No*				
Material Weakness	Beginning Balance	New	Resolved	Consolidated	Ending Balance
Total Material Weaknesses	*0*	-	-	-	*0*

Table 3.2 – Summary of Management Assurances

Effectiveness of Internal Control over Financial Reporting (FMFIA § 2)					
Statement of Assurance	*Unmodified*				
	Beginning Balance	New	Resolved	Consolidated	Ending Balance
Total Material Weaknesses	*0*	-	-	-	*0*
Effectiveness of Internal Control over Operations (FMFIA § 2)					
Statement of Assurance	*Unmodified*				
	Beginning Balance	New	Resolved	Consolidated	Ending Balance
Total Material Weaknesses	*0*	-	-	-	*0*
Conformance with Federal Financial Management System Requirements (FMFIA § 4)					
Statement of Assurance	*Systems conform to financial management system requirements*				
	Beginning Balance	New	Resolved	Consolidated	Ending Balance
Total non-conformances	*0*	-	-	-	*0*
Compliance with Section 803(a) of the Federal Financial Management Improvement Act (FFMIA)					
	Agency			Auditor	
1. Federal Financial Management System Requirements	*No lack of compliance noted*				
2. Applicable Federal Accounting Standards	*No lack of compliance noted*				
3. U.S. Standard General Ledger at Transaction Level	*No lack of compliance noted*				

Management Challenges for the National Science Foundation in Fiscal Year 2020

October 15, 2019

AT A GLANCE

Management Challenges for the National Science Foundation in Fiscal Year 2020

October 15, 2019

WHY WE DID THIS REPORT

The *Reports Consolidation Act of 2000* (Pub. L. No. 106-531) requires us to annually update our assessment of NSF's "most serious management and performance challenges facing the agency … and the agency's progress in addressing those challenges."

WHAT WE FOUND

NSF leads the world as an innovative agency dedicated to advancing science. Its support of basic research has led to many discoveries that have contributed to the progress of science, as well as the national health, prosperity, and welfare. Beyond its scientific mission, NSF must be a responsible steward of taxpayer dollars.

This year, we have identified six areas representing challenges NSF must continue to address to enhance mission performance:

- Managing Major Multi-User Research Facilities;
- Meeting Digital Accountability and Transparency Act of 2014 (DATA Act) Reporting Requirements;
- Managing the Intergovernmental Personnel Act Program;
- Managing the Antarctic Infrastructure Modernization for Science (AIMS) Project;
- Encouraging the Responsible and Ethical Conduct of Research; and
- Mitigating Threats Posed by Foreign Government Talent Recruitment Programs.

We have also removed one challenge identified in our FY 2019 Management Challenges report — Eliminating Improper Payments — based on NSF's significant progress in this area.
We are encouraged by NSF's progress in its efforts to address critical management and performance challenges. Effective responses to these challenges will continue to promote the integrity of NSF-funded projects, help ensure research funds are spent effectively and efficiently, and help maintain the highest level of accountability over taxpayer dollars.

AGENCY RESPONSE TO *MANAGEMENT CHALLENGES FOR FY 2019*

Following the issuance of this report, NSF will include its Management Challenges Progress Report and its response to *Management Challenges for the National Science Foundation in FY 2019* as part of its Agency Financial Report.

FOR FURTHER INFORMATION, CONTACT US AT OIGPUBLICAFFAIRS@NSF.GOV.

National Science Foundation • Office of Inspector General
2415 Eisenhower Avenue, Alexandria, Virginia 22314

MEMORANDUM

DATE: October 15, 2019

TO: Dr. Diane Souvaine
Chair
National Science Board

Dr. France Córdova
Director
National Science Foundation

FROM: Allison C. Lerner Allison C. Lerner
Inspector General
National Science Foundation

SUBJECT: Management Challenges for the National Science Foundation in Fiscal Year 2020

Attached for your information is our report, *Management Challenges for the National Science Foundation in Fiscal Year 2020*. The *Reports Consolidation Act of 2000* (Pub. L. No. 106-531) requires us to annually update our assessment of NSF's "most serious management and performance challenges facing the agency … and the agency's progress in addressing those challenges." A summary of the report will be included in the National Science Foundation Agency Financial Report.

If you have questions, please contact me at 703.292.7100.

Attachment

Table of Contents

Introduction

NSF leads the world as an innovative agency dedicated to advancing science. Its support of basic research has led to many discoveries that have contributed to the progress of science, as well as the national health, prosperity, and welfare. Beyond its scientific mission, NSF must be a responsible steward of taxpayer dollars.

The *Reports Consolidation Act of 2000* requires us to annually update our assessment of NSF's "most serious management and performance challenges facing the agency … and the agency's progress in addressing those challenges" (Pub. L. No. 106-531). Accordingly, we identify the challenges we consider most critical based on our audit and investigative work; general knowledge of the agency's operations; and evaluative reports of others, including the U.S. Government Accountability Office (GAO) and NSF's various advisory committees, contractors, and staff. We identify management challenges as those that meet at least one of the following criteria:

- The issue involves an operation that is critical to an NSF core mission.[1]
- There is a risk of fraud, waste, or abuse of NSF or other Government assets.
- The issue involves strategic alliances with other agencies, the Office of Management and Budget (OMB), the Administration, Congress, or the public.
- The issue is related to key initiatives of the President.
- The issue involves a legal or regulatory requirement not being met.

FY 2020 Challenges and Emerging Challenge

This year, we have identified six areas representing the most serious management and performance challenges for NSF:

- Managing Major Multi-User Research Facilities;
- Meeting *Digital Accountability and Transparency Act of 2014* (DATA Act) Reporting Requirements;
- Managing the *Intergovernmental Personnel Act* Program;
- Managing the Antarctic Infrastructure Modernization for Science (AIMS) Project;
- Encouraging the Responsible and Ethical Conduct of Research; and
- Mitigating Threats Posed by Foreign Government Talent Recruitment Programs.

We describe our work and NSF's progress in addressing these six critical challenges areas in more detail in the following pages.

We have also identified a new area — managing the enterprise-wide internal control environment — that we consider an emerging challenge for NSF. OMB requires Federal agencies to establish an effective, enterprise-wide control environment and integrate a risk-based approach towards meeting strategic, operational, reporting, and compliance objectives.[2] NSF has a proven track record of effectively overseeing each of its different functional areas, but gaps remain in addressing cross-functional issues. We have observed this issue in several ongoing audits, which we will finalize this fiscal year. Increasing collaboration between NSF's directorates, divisions, and offices may assist the agency in addressing this emerging challenge area.

[1] The *National Science Foundation Act of 1950* (Pub. L. No. 81-507) sets forth the mission: "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes."
[2] OMB M-18-16, Appendix A to OMB Circular No. A-123, *Management of Reporting and Data Integrity Risk*, June 6, 2018

Introduction

Progress in Addressing FY 2019 Challenges

We are encouraged by NSF's efforts to address critical management and performance challenges. For example, we have removed one challenge area identified in our FY 2019 Management Challenges report — Eliminating Improper Payments — based on NSF's efforts to demonstrate compliance and effectiveness in the agency's implementation of the *Improper Payments Elimination and Recovery Act of 2010* (IPERA).[3] Specifically, NSF published standard operating guidance for improper payments risk assessments incorporating the nine IPERA risk factors and additional considerations from our FY 2015 report. In addition, NSF completed a 3-year improper payments risk assessment throughout FY 2016, FY 2017, and FY 2018, which concluded that NSF did not have a significant risk of improper payments. Our inspections of the FY 2016 and FY 2017 risk assessment work, as well as our audit of the completed FY 2018 risk assessment, found NSF in compliance with IPERA requirements. Although NSF could improve its risk assessment process by ensuring that it obtains input from key personnel for all payment programs and activities, these actions, along with other agency activities, have enhanced our confidence that NSF will continue to comply with IPERA requirements.

NSF's effective responses to its serious management and performance challenges will continue to promote the integrity of NSF-funded projects, help ensure research funds are spent effectively and efficiently, and help maintain the highest level of accountability over taxpayer dollars.

[3] Pub. L. No. 111-204, as amended by *Improper Payments Elimination and Recovery Improvement Act of 2012* (IPERIA, Pub. L. No. 112-248)

CHALLENGE 1 Managing Major Multi-User Research Facilities

Why is this a serious management challenge? This challenge involves an operation that is critical to an NSF core mission.

As part of its mission, NSF funds the construction, management, and operation of major multi-user research facilities (major facilities), which are state-of-the art infrastructure for research and education and include telescopes, ships, distributed networks, and observatories. NSF's major facility portfolio is inherently risky because the facilities are naturally complex, and their construction and operating costs are high. For example, NSF's Antarctic Infrastructure Modernization for Science (AIMS) project is a $410 million, 10-year construction venture at McMurdo Station. In FY 2018, NSF spent $186 million constructing major facilities and more than $1 billion operating them.

Recent audits identified oversight concerns, including the need for strengthened controls to ensure major facilities clearly identify subrecipients, complete subrecipient risk assessments, and properly charge project expenditures to construction or operations. In addition, a March 2019 GAO report noted NSF should take additional steps to ensure NSF — and recipients constructing and operating major facilities — maintain project management expertise.

Over the past few years, NSF has worked diligently to address our and other auditors' recommendations. NSF has strengthened controls over its major facility portfolio and continues to complete additional steps to improve oversight.

Completed Actions

- ☑ Developed and implemented management reserve policies and procedures.
- ☑ Aligned Standard Operating Guidelines with the *American Innovation and Competitiveness Act*.
- ☑ Updated the terminology in NSF systems to allow recipients to more clearly identify subrecipients.
- ☑ Received an independent third-party review of NSF's cost surveillance procedures and developed a plan to address recommendations.
- ☑ Updated ship operations terms to provide better control over maintenance and repair costs.

Ongoing Actions

- ➢ Finalize and issue policies and procedures for segregation of funding plans and final construction reviews.
- ➢ Continue to draft new sections of the Major Facilities Guide on *Schedule, Development, Estimating, and Analysis* and *Key Personnel*.
- ➢ Initiate facilities portfolio workforce gap analysis.
- ➢ Finalize and issue revised Business System Review Guide to align with the Uniform Guidance.

CHALLENGE 2 Meeting DATA Act Reporting Requirements

Why is this a serious management challenge?

This challenge involves strategic alliances with other agencies, OMB, the Administration, Congress, or the public.

The *Digital Accountability and Transparency Act of 2014* (DATA Act, Pub. L. No. 113-101) requires Federal agencies to report quarterly spending data to the public through USASpending.gov, beginning with FY 2017 second quarter data. Federal agencies must report information in accordance with Government-wide financial data standards developed and issued by the OMB and the U.S. Department of the Treasury (Treasury).

In response to our November 2017 audit of NSF's FY 2017 second quarter spending data, NSF staff conducted a root cause analysis of its challenges, noting that many of the OIG-identified errors were Government-wide in nature and beyond NSF's control. NSF has taken several actions to improve the quality of its spending data, including leading Government-wide activities to implement OMB requirements (OMB M-18-16); supporting the Government-wide financial assistance community's work to develop the Data Quality Plan Playbook, a framework for the required data quality plans, which NSF leveraged to prepare its own plan; and leveraging enterprise risk management to assess the risk of reporting inaccurate data to Treasury.

However, our audit of NSF's FY 2019 first quarter spending data found that the data did not meet OMB quality requirements. Several data elements were inaccurate, incomplete, or untimely, with most errors stemming from NSF's assertion that certain award actions, such as deobligation or upward/downward modification of the original award amounts, are nonreportable.

NSF has taken action to improve DATA Act reporting. However, challenges remain in implementing a process to ensure all award actions are transparent to the public.

Completed Actions

- ☑ Participated in Government-wide working groups to develop a DATA Act Playbook to support Federal agencies' compliance and audit readiness.
- ☑ Developed and implemented an NSF DATA Act data quality plan that considers incremental risks to data quality in Federal spending data and identifies controls to manage such risks.
- ☑ Monitored changes to NSF systems to determine impact on DATA Act reporting.

Ongoing Actions

- ➢ Implement a SharePoint tool to assist in quarterly DATA Act submission process by tracking Division Director assurances and the Senior Accountable Official (SAO) certification.
- ➢ Continue to work closely with OMB, Treasury, and intra-Governmental groups.
- ➢ Continue to refine NSF's validation and submission process.
- ➢ Continue to collaborate with NSF OIG and GAO to support their audit responsibilities and to resolve any recommendations through implementing a corrective action plan.

CHALLENGE 3 Managing the Intergovernmental Personnel Act Program

Why is this a serious management challenge? This challenge involves an operation that is critical to an NSF core mission.

NSF gives scientists, engineers, and educators the opportunity to temporarily serve as NSF program directors, advisors, and senior leaders. Most non-permanent staff members are individuals assigned under the *Intergovernmental Personnel Act* (IPA, Pub. L. No. 91-648), who are not Federal employees but are paid through grants and remain employees of their home institutions. These individuals — hereafter referred to as IPAs or rotators — bring in fresh perspectives from across all fields of science and engineering to support NSF's mission. However, IPAs can have a heightened risk of conflicts of interest while working at NSF because most IPAs come from institutions receiving NSF grants. Also, because they only serve up to 4 years, there is frequent staff turnover at NSF, especially in senior leadership positions filled by IPAs. In addition, IPAs can spend up to 50 days each year on Independent Research/Development (IR/D) and their salaries are not subject to Federal pay and benefits limits.

NSF is working to strengthen its management of the program. The IPA Steering Committee — established in 2016 in response to our 2013 audit report — continues to require every IPA's home institution to pay 10 percent of the IPA's academic-year salary and benefits under the cost-share pilot program it initiated in FY 2017. In addition, according to NSF's FY 2018 IPA program annual report, "Since the IPA cost-share policy pilot was implemented in FY 2016, NSF experienced a nearly 2 percent increase in average cost-share from 7.2 percent to 9.1 percent in FY 2018." Nevertheless, the IPA program remains an area with inherent risk that NSF must continue to monitor and mitigate.

Completed Actions

- ☑ Completed the first IPA Program Annual Report.
- ☑ Monitored time staff spent on IR/D and provided data to senior managers.
- ☑ Reported on year two of the cost-share pilot.
- ☑ Reported to Congress justifications for rotator pay exceeding the maximum Senior Executive Service (SES) pay.
- ☑ Established a process to ensure IPAs attend exit interviews that explain post-employment restrictions.

Ongoing Actions

- ➢ Report on year three of the cost-share pilot.
- ➢ Complete the development of an agency-wide workforce strategy for balancing use of IPA and other rotators with permanent staff.
- ➢ Continue to prepare an IPA Program Annual Report.
- ➢ Continue to provide quarterly data to senior managers on staff IR/D time and travel.
- ➢ Continue to submit to Congress annual justifications for rotator pay exceeding the maximum SES pay.

CHALLENGE 4 Managing the Antarctic Infrastructure Modernization for Science (AIMS) Project

Why is this a serious management challenge?

This challenge involves an operation that is critical to an NSF core mission.

NSF, through the United States Antarctic Program (USAP), manages U.S. scientific research in Antarctica. Leidos Innovations Corporation (Leidos) currently holds the Antarctic Support Contract (ASC) for USAP logistical support. It is NSF's largest contract, valued at $2.3 billion over 13 years. NSF recently initiated a $410 million project to update and consolidate the footprint of McMurdo Station. The Office of Polar Programs (OPP), in coordination with NSF's Large Facilities Office, is managing the Antarctic Infrastructure Modernization for Science (AIMS) project as a series of modifications to the existing ASC with Leidos. This anticipated 10-year project, to be completed in phases, will stretch agency resources and may present additional challenges for NSF to overcome. In addition, OPP is currently overseeing a separate ASC contract modification with Leidos to build an Information Technology & Communications (IT&C) primary facility — a key precursor to the success of AIMS.

NSF has committed to completing the AIMS project without impacting scientific research. This commitment, the inherent risk of the ASC, the remote and isolated environment coupled with the harsh climate of Antarctica, and the capacity of the prime contractor to effectively manage this complex project will require continued vigilance.

Completed Actions

- ☑ Finalized updates to the Selection of Independent Cost Estimate Reviews standard operating guidance and the Major Facilities Guide (MFG).
- ☑ Received the independent third-party report related to cost surveillance of Leidos; developed an implementation plan to address the findings and recommendations.
- ☑ Revised the ASC Award Fee Plan to include Notable Outcome metrics.
- ☑ Implemented formal ASC Project Execution Plans and Funding Guidance memoranda.
- ☑ Instituted monthly ASC project reviews and weekly financial reviews.
- ☑ Established Quality Assurance and Project Management teams at Leidos.

Ongoing Actions

- ➢ Initiate major facilities portfolio workforce gap analysis.
- ➢ Revise Major Facilities Cooperative Agreement Supplemental Terms and Conditions.
- ➢ Finalize the new *Major Facilities Oversight Reviews* standard operating guidance.
- ➢ Continue to draft new sections of the MFG on *Schedule, Development, Estimating, and Analysis* and *Key Personnel*.
- ➢ Implement function-specific technical measures as part of the ASC Award Fee Plan.

CHALLENGE 5 Encouraging the Responsible and Ethical Conduct of Research

Why is this a serious management challenge?

This challenge involves an operation that is critical to an NSF core mission. There is also risk of fraud, waste, or abuse of NSF or other Government assets.

To achieve excellence and maintain the public's trust, researchers must commit to the responsible and ethical conduct of research. In addition to avoiding research misconduct (fabrication, falsification, or plagiarism), this commitment includes protecting research subjects; mentoring; ensuring responsible authorship; managing conflicts of interests; protecting data integrity; and establishing research environments free of harassment.

We are encouraged by NSF's actions to strengthen training in the responsible conduct of research (RCR) at NSF-funded institutions, as required by the *America COMPETES Act* (Pub. L. No. 110-69) and in response to our 2017 report on institutional implementation of RCR training. However, opportunities for improvement exist. For example, the House Report accompanying the Act included expectations that NSF "promptly develop and provide written guidelines and/or templates for universities to follow so that compliance can be verified by all parties." NSF has shared training resources in its draft 2020 *Proposal and Award Policies and Procedures Guide* (PAPPG); however, written guidelines or templates could help NSF ensure the training is of sufficient quality and complies with RCR training requirements as the Act intended. Written guidelines or templates could also help recipients create RCR training curricula that NSF deems appropriate. Finally, because the National Institutes of Health (NIH) provides RCR guidelines, some institutions receiving funding from both agencies have developed and maintain two separate RCR programs. NSF could ease this burden on recipients and strengthen the impact of RCR training by working with NIH to harmonize these expectations as much as possible.

NSF has committed to ensuring the research environments it supports are free of harassment, and it has continued to emphasize its culture of zero tolerance for harassment of any kind by NSF staff or individuals who receive its funding. For example, it has supported the National Academies of Science, Engineering, and Medicine's (NASEM) efforts to prevent sexual harassment and the Global Research Council's efforts to promote the equality and status of women in research. NSF also published a new award term and condition, effective October 22, 2018, entitled "Notification Requirements Regarding Findings of Sexual Harassment, Other Forms of Harassment, or Sexual Assault." In addition, NSF provides a process by which any individual may report allegations of harassment involving an NSF-funded program directly to NSF's Office of Diversity and Inclusion. NSF's challenge lies in ensuring that such reports are properly made — and that it has enough staff and resources to respond to this new body of work.

Completed Actions

- ☑ Defined responsible and ethical conduct of research (RECR) and provided references for designing RECR training in draft 2020 PAPPG.
- ☑ Presented guidance on RECR to research integrity officers and other research administrators.
- ☑ Funded Online Ethics Center workshop.
- ☑ Revised solicitation for Ethical and Responsible Research Program.
- ☑ Supported NASEM report on sexual harassment.
- ☑ Published new term and condition on notification of findings of harassment or sexual assault.

Ongoing Actions

- ➢ Publish final 2020 PAPPG and develop further improvements for the 2021 PAPPG based on community feedback.
- ➢ Hold online ethics promising practices workshop.
- ➢ Hold workshop for science, technology, engineering, and mathematics (STEM) faculty on teaching ethics.
- ➢ Develop Dear Colleague Letter regarding research opportunities in areas recommended by the NASEM report on sexual harassment.

CHALLENGE 6 Mitigating Threats Posed by Foreign Government Talent Recruitment Programs

Why is this a serious management challenge?

This challenge involves an operation that is critical to an NSF core mission. There is also risk of fraud, waste, or abuse of NSF or other Government assets.

NSF, and other agencies that fund basic research, are facing increasing challenges from programs sponsored by some foreign governments or affiliates, referred to as "foreign government talent recruitment programs." These programs — designed to benefit the foreign state's economic development, industry, and national security by obtaining information and technology from abroad — have the potential to exploit the openness of American universities and threaten the integrity of U.S. research initiatives.

Talent recruitment programs target individuals with expertise in cutting-edge science, including NSF-funded researchers, merit review panelists, and career Federal employees or rotators who manage NSF's scientific programs. Some plans have required members to affirmatively demonstrate their involvement in research or technology development, sometimes by providing information that is proprietary or export controlled. These plans often use contracts to establish the relationship between the plan and the scientist. The contracts can contain provisions related to the scientists' intellectual activities and output, which may raise significant questions about ownership of intellectual property developed with NSF funding and create conflicts of interests and commitments. Failure to properly disclose membership in such programs can also have criminal or civil ramifications.

NSF has begun taking action to confront the challenges presented by foreign talent recruitment programs. NSF should continue to assess and refine its controls in this area and should work to ensure that it has sufficient staff and resources to respond to this challenge.

Completed Actions

- ☑ Issued a requirement that IPA Program staff working at NSF must be U.S. citizens or have applied for U.S. citizenship.
- ☑ Issued a personnel policy prohibiting NSF employees and IPA Program staff from participating in foreign government talent recruitment programs.
- ☑ Commissioned an independent advisory group to conduct a study and recommend practices for NSF and its award recipients to achieve the best balance between scientific openness and security.

Ongoing Actions

- ➢ Publish final 2020 PAPPG, including clarifications regarding reporting requirements for current and pending support and professional appointments.
- ➢ Develop electronic formats for submission of biographical sketches, disclosure of appointments, and disclosure of current and pending support information.
- ➢ Strengthen and improve certifications relating to representations and disclosures made in proposals and/or other communications with NSF.

Appendix A: Relevant Reports

Please visit http://www.nsf.gov/oig for additional reports and publications.

Introduction

- NSF OIG Report, *Management Challenges for the National Science Foundation in FY 2019*, Oct. 12, 2018
- NSF OIG Report No. 19-2-005, *Performance Audit over the Improper Payments Elimination and Recovery Act*, May 10, 2019
- NSF OIG Memorandum, *IPERA Compliance*, April 30, 2018
- NSF OIG Report No. 17-3-005, *Inspection of the National Science Foundation's Compliance with the Improper Payments Elimination and Recovery Act of 2010 for FY 2016*, May 16, 2017
- NSF OIG Report No. 16-3-005, *NSF's Compliance with the Improper Payments Elimination and Recovery Act for FY 2015*, May 12, 2016

Managing Major Multi-User Research Facilities

- NSF OIG Report No. 19-2-006, *Audit of NSF's Controls to Prevent Misallocation of Major Facility Expenses*, June 21, 2019
- NSF OIG Report No. 18-2-005, *Audit of NSF's Oversight of Subrecipient Monitoring*, June 21, 2018
- NSF OIG Report No. 17-3-004, *NSF Needs Stronger Controls Over Battelle Memorial Institute Award for the National Ecological Observatory Network*, May 12, 2017
- GAO-19-227, *National Science Foundation: Cost and Schedule Performance of Large Facilities Construction Projects and Opportunities to Improve Project Management*, March 27, 2019

Meeting Digital Accountability and Transparency Act of 2014 (DATA Act) Reporting Requirements

- NSF OIG Report No. 18-2-001, *Implementation of the Digital Accountability and Transparency Act of 2014*, Nov. 17, 2017

Managing the Intergovernmental Personnel Act Program

- NSF OIG Report No. 17-2-008, *NSF Controls to Mitigate IPA Conflicts of Interest*, June 8, 2017
- NSF OIG Report No. 13-2-008, *Audit of Cost Associated with NSF's Use of Intergovernmental Personnel Act Assignees*, March 20, 2013

Encouraging the Responsible and Ethical Conduct of Research

- NSF OIG Tracking No. PR12030006, *OIG Review of Institutions' Implementation of NSF's Responsible Conduct of Research Requirements*, July 25, 2017
- H. Rept. 110-289, *Conference Report, 21ST Century Competitiveness Act*, 2017
- NSF Office of the Director Staff Memorandum, O/D 18-18, *NSF is Committed to Stopping Harassment in Research and Learning Environments*, Sept. 19, 2018
- NSF Office of the Director Important Notice No. 144, *Harassment*, Feb. 8, 2018
- NSF ODI Bulletin No. 18-01, Sexual Harassment Reporting
- NSF Office of the Director Important Notice No. 140, *Training in Responsible Conduct of Research – A Reminder of the NSF Requirement*, August 17, 2017
- NASEM Consensus Study Report, *Sexual Harassment of Women: Climate, Culture, and Consequences in Academic Sciences, Engineering, and Medicine*, 2018

Additional Information

About NSF OIG

We promote effectiveness, efficiency, and economy in administering the Foundation's programs; detect and prevent fraud, waste, and abuse within NSF or by individuals who receive NSF funding; and identify and help to resolve cases of research misconduct. NSF OIG was established in 1989, in compliance with the *Inspector General Act of 1978*, as amended. Because the Inspector General reports directly to the National Science Board and Congress, the Office is organizationally independent from the National Science Foundation.

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- File online report: https://www.nsf.gov/oig/report-fraud/form.jsp
- Anonymous Hotline: 1.800.428.2189
- Mail: 2415 Eisenhower Avenue, Alexandria, VA 22314 ATTN: OIG HOTLINE

National Science Foundation
Office of the Director

MEMORANDUM

DATE: OCT 2 2 2019

TO: Ms. Allison C. Lerner
Inspector General, National Science Foundation

FROM: Dr. France Córdova
Director, National Science Foundation

SUBJECT: Acknowledgement of the Inspector General's FY 2020 Management Challenges Report and Transmittal of NSF's Progress Report for the FY 2019 Management Challenges

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As Director of the National Science Foundation (NSF), I recognize the importance of acknowledging, understanding, and mitigating risk to the execution of our mission and stewardship of taxpayer dollars. Consistent with this focus, as well as statute, this memorandum provides you with NSF's Progress Report for the Office of Inspector General's (OIG) Management Challenges for FY 2019 and acknowledges my receipt of the OIG's Management Challenges for FY 2020. As you review our Progress Report, here are three considerations:

First, we are pleased that the OIG has removed a Management Challenge for FY 2019, Eliminating Improper Payments. More broadly, we appreciate the OIG's continued reporting of Management Challenges in a streamlined, clear document, which recognizes progress we have made in different challenge areas. Similarly, we believe that by continuing to apply the Enterprise Risk Management framework at NSF to document our assessments of the risks for each of the OIG's Challenges for FY 2019, we provide a detailed view of what we have accomplished and what remains ahead.

Second, we appreciated the OIG's identification of an emerging challenge area in last year's Management Challenge Report on foreign talent plans. This provided NSF with notice and opportunity to undertake responsive actions before the OIG decided this month to elevate the issue to a standalone Management Challenge for FY 2020. To that end, in consultation with the OIG's Office of Investigations, NSF initiated actions in FY 2019, with actions planned for FY 2020, directed to concerns arising from foreign talent programs. We have added a summary of these actions in the attached Progress Report.

Third, as we engage the leaders for the OIG's Management Challenges for FY 2020, we highlight the following about each new challenge:

- Managing Major Multi-User Facilities: We look forward to completing corrective actions recommended by the OIG, including developing segregation of funding plans and controls related to subrecipients. These actions, in the context of our regular updates to the Major Facilities Guide, are part of our continuous improvement of the oversight and management of major facilities.

2415 Eisenhower Avenue | Alexandria, VA 22314

- Meeting Digital Accountability and Transparency Act of 2014 (DATA Act) Reporting Requirements: We appreciate that the OIG has recognized our leadership in Government-wide activities to implement the DATA Act requirements. We look forward to fully considering the OIG's findings and recommendations when the OIG issues its report next month for NSF's DATA Act compliance for FY 2019 first quarter spending data and to obtaining a common understanding on Office of Management and Budget (OMB) quality requirements.

- Managing the Intergovernmental Personnel Act (IPA) Program: We will continue (a) to review data and reports related to the IPA program to identify opportunities for improvement; and (b) to address the recommendations in the Government Accountability Office's (GAO) review of rotators.

- Managing the Antarctic Infrastructure Modernization for Science (AIMS) Project: As recognized by the OIG, NSF has taken several actions to mitigate the risks of the AIMS Project, including phasing AIMS procurement approvals and enlisting a third-party quality assurance review capability through an agreement with the U.S. Army Corps of Engineers. We will continue diligent and effective AIMS project management, to include areas of procurement, logistics, planning, and design.

- Encouraging the Responsible and Ethical Conduct of Research: We appreciate the OIG's recognition that the Responsible and Ethical Conduct of Research extends beyond avoiding research misconduct to include, for example, mentoring, managing conflicts of interest, and establishing research environments free of harassment. NSF, through recently proposed changes to its Proposal and Award Policies and Procedures Guide, emphasizes this broader focus.

- Mitigating Threats Posed by Foreign Government Talent Recruitment Programs: We appreciate our robust, constructive engagement with the OIG in this area of focus. We note that the White House Office of Science and Technology Policy is leading multi-sector activity related to research security, including foreign talent plans. We affirm that maintaining strong communication with the OIG builds greater understanding of the scope and nature of this new challenge area.

We look forward to addressing the OIG's Management Challenges for FY 2020 and, more broadly, to continuing our constructive engagement with the OIG about risk management for NSF.

Enclosure

cc: Chair, National Science Board
Chair, National Science Board, Committee on Oversight
Chief Financial Officer

National Science Foundation (NSF)
FY 2019 Progress Report on OIG Management Challenges

MANAGEMENT CHALLENGE 1: Managing Major Multi-User Research Facilities

NSF Lead: Teresa Grancorvitz, Chief Financial Officer and Jim Ulvestad, Chief Officer for Research Facilities

Summary of OIG Identified Challenge

a) Manage inherent risk associated with previously highlighted concerns including unsupported proposal budgets, management fees and contingency funds, and the absence of certified earned value management systems.
b) Strengthen controls around subrecipients, subrecipient risk assessments and proper charging of construction and operations expenditures.
c) Manage the risk of cost or schedule increases for major facilities in construction.

NSF Management's Overview of the Challenge and Action Plan to Address and Monitor the Challenge

NSF's view of the residual risk considering key actions taken to achieve the objective of the challenge.

NSF understands the importance of its role in overseeing recipients' on-going management of major facility awards. The agency also recognizes the importance of assessing prospective recipients' capabilities for managing major facilities prior to award. Over the past several years, NSF has been in the process of strengthening its policies and procedures as illustrated below. This includes an annual Major Facilities Portfolio Risk Assessment to determine the necessary reviews and audits to be conducted by the Office of Budget, Finance and Award Management's (BFA) Large Facilities Office (LFO) and Cooperative Support Branch (CSB) within the Division of Acquisition and Cooperative Support (DACS). In close cooperation with NSF program offices, LFO and CSB conduct these reviews to safeguard NSF's significant, long-term investments in supporting the scientific endeavor. NSF leadership has shown its commitment to oversight in the past several years by strengthening the LFO and in establishing the Chief Officer for Research Facilities (CORF) position in the Office of the Director. The governance structure currently in place continues to help ensure consistent implementation of NSF's expanded controls for major facilities oversight.

NSF has recently undergone two Government Accountability Office (GAO) reviews related to its oversight of major facilities. The June 2018 report entitled *National Science Foundation: Revised Policies on Developing Costs and Schedules Could Improve Estimates for Large Facilities* (GAO-18-

370) recommended that NSF should revise its policies for estimating and reviewing the costs and schedules of major facility projects to better incorporate the best practices in GAO's guides. The March 2019 report entitled *National Science Foundation: Cost and Schedule Performance of Large Facilities Construction Projects and Opportunities to Improve Project Management* (GAO-19-227) recommended that NSF conduct a workforce gap analysis for project management competencies, ensure recipients provide lessons learned and best practices to NSF, and establish criteria for recipient project management competencies to be incorporated into NSF's review process. NSF agreed with the GAO recommendations and has Corrective Action Plans (CAPs) in place as described below.

Based on NSF's risk-based evaluation of this Management Challenge, coupled with activities already completed and those planned for FY 2020, NSF has determined that the residual risk impact for cost overruns is "very low" and the likelihood is "low." NSF is confident that its current and planned policies and procedures related to major facility cost and schedule oversight adequately consider and balance risk, resources, benefit to the science community, and stewardship of federal funds.

NSF's Corrective Measures to Address the Challenge

Demonstrated Progress Through Agency Actions Taken in Prior Fiscal Years (FY 2016 - 2017)

Strengthened controls over NSF's major facility portfolio in FY 2016 and FY 2017 based on the 2015 National Academy of Public Administration report recommendations and requirements in the American Innovation and Competitiveness Act of 2017 (AICA):

- Retaining a portion of the project budget contingency.
- Periodically conducting cost incurred audits.
- Completing reasonableness review of proposed costs in alignment with GAO good practices.
- Obtaining independent cost estimate reviews of the proposed construction and operations budgets in accordance with GAO good practices.
- Conducting earned value management system verification, validation and acceptance.
- Reviewing proposed fees for prohibited items and requiring Recipients to track fee expenditures.
- Developed the Major Facilities A-123 Oversight Process Narrative to summarize NSF's oversight processes.
- Revised the *Large Facilities Manual* (LFM) to incorporate new guidance for recipients related to cost estimating and analysis in accordance with GAO good practices.

FY 2018 Progress:

- Appointed CORF in the Office of the Director to address full life-cycle oversight, including strategic portfolio issues and promoting agency-wide acceptance of policies and procedures related to major facility oversight.
- Appointed an Accountable Directorate Representative (ADR) in each Directorate with major facilities and formed the Major Facilities Working Group (consisting of the ADRs) to review and socialize policies and procedures related to major facility oversight.

- Formed the Facilities Governance Board to approve major facility oversight policies and procedures at the agency level.
- Reinstituted the MREFC Panel as the Facilities Readiness Panel (FRP) to access only technical readiness for advancement through the Design Stage and into the Construction Stage.
- Revised the Integrated Project Team (IPT) Standard Operating Guidance (SOG) to include facilities in the Operations Stage.
- Developed the *Minimum Core Competency for Oversight of Major Facilities* SOG to codify the minimum competencies for the core IPT members.
- Conducted an independent third-party review of NSF's strengthened policies and procedures related to cost surveillance.
- Updated the *DACS/CSB Standardized Cost Analysis Guidance* SOG to include assessment of schedule due to the potential impact on costs.
- Revised and aligned BFA SOGs related to standardized cost analysis and pre-award budget reviews to specifically address AICA requirements and GAO good practices.

Demonstrated Progress Through Agency Actions Taken in FY 2019

- Finalized *Selection of Independent Cost Estimate Review*s SOG already implemented in practice as part of the CAP for GAO-18-370.
- Revised the *Major Facilities Guide* (MFG), formerly the LFM, to incorporate GAO good practices on costs and to reserve a new section (4.3) on Schedule Development, Estimating, and Analysis as part of the CAP for GAO-18-370 and to include a requirement for Segregation of Funding Plans (section 3.4) and guidance on Final Construction Reviews (section 2.4.2).
- Received notification in September 2019 from GAO that the analysis by the GAO engineering sciences team found that NSF's practices in the new Major Facilities Guide and internal standard operating guidance fully meet GAO good practices.
- Drafted the *Major Facilities Oversight Reviews* SOG to more fully utilize external review panels in addressing elements of cost and schedule as part of the CAP for GAO-18-370.
- Received the independent third-party report related to cost surveillance; developed an implementation plan to address the findings and recommendations.
- Revised SOG 16-4 *DACS/CSB Standardized Cost Analysis Guidance* and SOG 17-3 *Guidance on Pre- and Post-Award Cost Monitoring Procedures for Large Facility Construction and Operations Awards Administered by CSB* to align with the AICA.

NSF's Anticipated Action Plan Milestones

NSF management developed the anticipated milestones below in consideration of NSF's strategic and operational objectives, the risks inherent to achieving these objectives, and the key actions NSF has already taken in response to those risks.

- Initiate major facilities portfolio workforce gap analysis as part of Program Management Improvement Accountability Act (PMIAA) implementation and the CAP for GAO-19-227.

- Revise Major Facilities Cooperative Agreement Supplemental Terms and Conditions (and any major facility contract terms and conditions) to require recipients to participate in NSF's Knowledge Management Program as part of the CAP for GAO-19-227.
- Finalize the new *Major Facilities Oversight Reviews* SOG to more fully utilize external review panels in addressing elements of cost and schedule and to evaluate the competencies of Recipient Key Personnel (GAO-18-370 and GAO-19-227).
- Draft the new MFG Section 4.3, *Schedule Development, Estimating, and Analysis* and release for public comment.
- Draft new MFG Section on *Key Personnel* and release for public comment as part of CAP for GAO-19-227.

MANAGEMENT CHALLENGE 2: Meeting DATA Act Reporting Requirements

NSF Lead: Teresa Grancorvitz, Chief Financial Officer and Wonzie Gardner, Office Head, Office of Information and Resource Management (OIRM)

Summary of OIG Identified Challenge

NSF must report DATA Act information in accordance with government-wide financial data standards developed and issued by the Office of Management and Budget (OMB) and the U.S. Department of the Treasury.

NSF Management's Overview of the Challenge and Action Plan to Address and Monitor the Challenge

NSF's view of the residual risk considering key actions taken to achieve the objective of the challenge.

Each quarter, NSF successfully submits all DATA Act-required data to the U.S. Department of Treasury to be easily accessible to the public through USASpending.gov. In addition to these submissions, which began in April 2017, NSF is an integral part of the government-wide Chief Financial Officers Council (CFOC) and Council of Inspectors General on Integrity and Efficiency (CIGIE) communities that have worked collaboratively to ensure new OMB guidance and Treasury protocols appropriately align with audit community standards. Both councils are working to enhance not only the quality of government-wide spending data, but also the government's ability to assess that quality. As a result of this work, NSF implemented a data quality plan that is based on a government-wide model and conducted a risk assessment demonstrating that it has implemented internal controls to mitigate the risks associated with maintaining and publishing inaccurate spending data. NSF continues to deploy top leadership commitment to the management of its DATA Act program, including the agency CFO who serves as the Senior Accountable Official (SAO), the Deputy CFO, an executive-level Steering Committee, and several additional high-level executives and senior staffers.

In FY 2019, NSF continued to take actions in accordance with the recommendations from the NSF OIG's audit of NSF's FY 2017 second quarter spending data that were resolved and closed in FY 2018. These actions made progress to address the OIG finding that the data did not meet the then-current OMB quality requirements for accuracy, completeness and timeliness, noting that some of the errors were due to NSF reporting while others were caused by government-wide reporting issues. NSF conducted a root cause analysis of its challenges and noted that many of the OIG-identified errors were government-wide in nature and beyond NSF's control. NSF implemented a CAP after the FY 2017 audit, ultimately resolving all recommendations and the OIG has closed them all. Indeed, in the description of the FY 2019 DATA Act Management Challenge, the OIG noted that it is "encouraged by NSF's actions to improve its DATA Act reporting."

NSF has had a recognized history of outstanding government-wide DATA Act-related collaboration. In FY 2019, NSF intensified its leadership and engagement in this area not only to support government-wide DATA Act-related activities, but also to ensure that the developing standards in this area evolved to align with best practices and good governance for agencies like NSF. In FY 2019, NSF collaborated and led government-wide activities implementing now-current guidance, OMB M-18-16, updating Appendix A to OMB Circular No. A-123, Management of Reporting and Data Integrity Risk. This new guidance superseded prior DATA Act guidance and created a requirement for agencies to develop data quality plans that include management assurance of the quality of agency data.

NSF's progress on the DATA Act has been aided by the NSF Deputy CFO and other staff deeply engaging in supporting the activities relating to the Audit Collaboration Working Group of the CFOC and CIGIE. NSF was a major contributor in developing the Data Quality Plan Playbook, which serves as a reference guide for agencies designing their data quality plans. The CFOC also collaborated with GAO and CIGIE as they developed new audit guidelines and standards consistent with the new OMB guidance. In addition, the NSF Division Director for BFA's Division of Institution and Award Support and other NSF senior staff supported the government-wide financial assistance community's work to develop a framework for the required data quality plans, which NSF leveraged to prepare its own plan.

As part of its work to achieve reasonable assurance for internal controls over DATA Act reporting, NSF leveraged enterprise risk management to assess the risk of reporting inaccurate data to Treasury. Based on this evaluation and considering the causes analyzed and actions that NSF has taken to date, NSF believes that its risk of reporting inaccurate, incomplete, and untimely data has been mitigated.

NSF's Corrective Measures to Address the Challenge

Demonstrated Progress Through Action Taken in Prior Fiscal Years (FY 2018)

Developed and implemented CAP in response to the FY 2017 audit with the following actions:

- Examined processes identified as potential audit risks, identified ways to improve or strengthen the processes, and documented changes in NSF's standard operating procedures.
- Submitted corrections for data errors identified in the audit.

- Included comments with NSF's submissions to explain legitimate differences between File C (Award and Financial Detail) and Files D1/D2 (Financial Assistance and Procurement Award and Awardee Attributes).
- Reviewed submission process with the internal controls team and identified opportunities for improvement.
- Performed policy review of the application of "legitimate differences" guidance to warnings when linking Files C to D1/D2.
- Worked closely with the DATA Act Audit Collaboration Working Group of the CFOC and CIGIE to identify issues to improve DATA Act implementation and clarify government-wide guidance and audit standards.
- Worked with a subgroup of the Financial Assistance Committee for E-Government (FACE) in collaboration with a DATA Act Internal Control subgroup of the CFOC to provide a solid framework and data quality plan template that agencies can leverage and customize to develop their own data quality plans.
- Initiated implementation of OMB Circular A-123 Appendix A, requiring agencies to maintain a data quality plan that considers the incremental risks to data quality in federal spending data and any controls that would manage such risks. NSF's data quality plan will leverage the existing plans for the Financial (Files A-C) and Procurement (File D1) data as well incorporate the new data quality requirements for the Financial Assistance (File D2) data.
- Reviewed SharePoint processes to ensure all required BFA Division Director validations are complete, properly labelled, and available for SAO review.

Demonstrated Progress Through Actions Taken in FY 2019

- Devoted the staff resources to actively participate in the CFOC DATA Act Information Model Schema (DAIMS) workgroup on data quality improvements, which is a cross-agency group led by Treasury for introducing potential improvements to the DAIMS specifications for improving data quality on USASpending.gov. NSF worked to get the issue with zip codes resolved and incorporated into DAIMS v1.3 specifications.
- Continued ongoing work, through the NSF Deputy CFO and staff, with the joint working group of the CFOC and the CIGIE to provide input and recommendations around the next iteration of DATA Act policies, internal control, and audit guidance to OMB, Treasury, and CIGIE.
- Committed the NSF Deputy CFO to leading a subgroup on internal controls, serving as primary author of a government-wide DATA Act Playbook, and actively participating in developing best practices for financial assistance data quality.
- Instituted processes to monitor and independently validate the effectiveness and sustainability of its data quality measures. The NSF DATA Act Work Group (DAWG) worked with appropriate stakeholders from the Internal Controls and Enterprise Risk Management groups in developing and executing a data quality plan that defines NSF's FY 2019 approach to achieve reasonable assurance for internal control over quarterly DATA Act reporting. The plan was prepared in accordance with OMB M-18-16, Appendix A to OMB Circular No. A-123.
- Conducted a risk assessment of the 57 essential reporting elements related to procurement, financial management and financial assistance data and submission processes and reviewed related system controls and Standard Operating Procedures (SOPs).

- Performed analysis of NSF's submission warnings to provide warning rationales, counts, and frequency of each identified warning during the execution phase of the data quality plan. This practice will continue with each quarterly submission and be reported in the annual assurance document.
- Updated documentation of DATA Act processes including, the DATA Act SOPs, Financial Assistance Broker Submission Standard Operating Guidance (FABS SOG), and NSF Acquisition Manual.
- Continued to monitor system processes to ensure data integrity and accuracy.
- Remained up-to-date with Treasury DAIMS specifications by making appropriate changes as well as introduced operational improvements to FABS file generation.
- Created a desk guide for the NSF Contracts Branch that includes step-by-step instructions intended to reduce recurring data errors.
- Added additional dry run and pre-validations between data submission quarters to increase accuracy.
- Incorporated lessons learned from feedback on data submissions to improve accuracy and efficiencies.

NSF's Anticipated Action Plan Milestones

NSF management developed the anticipated milestones below in consideration of NSF's strategic and operational objectives, the risks inherent to achieving these objectives, and the key actions NSF has already taken to address those risks.

- Implementing a SharePoint tool to assist in quarterly DATA Act submission process by tracking Division Director assurances and the SAO certification.
- Continuing to work closely with OMB, Treasury, and intra-governmental groups.
- Continuing to refine our validation and submission process.
- Continuing stewardship collaboration with NSF OIG and GAO to cooperate with and support their audit responsibilities and to resolve any recommendations through implementing a corrective action plan.

MANAGEMENT CHALLENGE 3: Eliminating Improper Payments

NSF Lead: Teresa Grancorvitz, Chief Financial Officer

Summary of OIG Identified Challenge

a) There is a risk of fraud, waste, or abuse of NSF or other government assets. In addition, this challenge involves an operation that is related to key initiatives of the President.

b) NSF's risk assessment process needed significant improvements to ensure that the agency thoroughly assesses and documents its risk of improper payments, and

c) addresses the limitations in NSF's analysis of the OMB risk factors.

NSF Management's Overview of the Challenge and Action Plan to Address and Monitor the Challenge

NSF's view of the residual risk considering key actions taken to achieve the objective of the challenge.

NSF addressed the OIG's recommendations from the previous OIG reports. As a result, the OIG has determined that NSF was in compliance with the Improper Payment Elimination and Recovery Act (IPERA) risk for the years 2015 through 2018. This validates that NSF has taken the steps necessary to demonstrate compliance and effectiveness in the agency's implementation of IPERA. NSF has:

- Demonstrated strong commitment and top leadership support to incorporate risk management concepts into business processes and management functions.
- Participated in the government-wide working group for the cross-agency priority goal on Getting Payments Right.
- Ensured that NSF has the people and resources to effectively comply with IPERA by assigning a senior staff associate responsible for coordinating and integrating risk management and program integrity activities.
- Developed and completed a corrective action plan in July 2016 that addressed the root causes of the IPERA reporting issue, implemented solutions, and completed all OIG recommendations.
- Developed a corrective action plan following the FY 2018 IPERA Performance Audit.
- Established processes to monitor and validate the effectiveness and sustainability of the corrective measures.
- Incorporated corrective measures into policy and process documentation.

NSF's Corrective Measures to Address the Challenge

Demonstrated Progress Through Actions Taken in Prior Fiscal Years

- Developed and published a SOG for improper payments risk reviews incorporating the nine IPERA risk factors and additional considerations from the OIG review report.
- Completed improper payments risk reviews for FY 2016 and FY 2017. The risk reviews included input from subject matter experts for grants, contracts, charge cards, and payments to employees. Both reviews concluded that NSF did not have a significant risk of improper payments.
- OIG inspection of the FY 2016 and FY 2017 risk reviews found NSF in compliance with IPERA requirements.
- Collaborated with the OIG, BFA, and program offices on risk reduction activities including completion of an initial fraud risk assessment for grants under the Fraud Reduction and Data Analytics Act.
- Completed an improper payments risk assessment for FY 2018 that built on the improper payments risk reviews completed during FY 2016 and FY 2017.

Demonstrated Progress Through Actions Taken in FY 2019

- Conducted advanced and baseline grant monitoring activities including grant payment testing.
- Operated, evaluated, and reported on an effective internal controls program providing assurance that NSF controls over grants and grant payment processes are properly designed and operating effectively.
- Completed an IPERA risk review during FY 2019 as a continuation of NSF's three-year risk assessment cycle following standard operating guidance establishing a validated measure of performance in terms of monitoring improper payment risk. OIG found that NSF complied with IPERA reporting requirements based on review of NSF's Agency Financial Report and risk assessment. This is the fourth consecutive year NSF has been found compliant.
- Completed action items set forth in the CAP from the FY 2018 IPERA Performance Audit.

NSF's Anticipated Milestones

NSF management developed the anticipated milestones below in consideration of NSF's strategic and operational objectives, the risks inherent to achieving these objectives, and the key actions NSF has already taken in response to those risks.

- Continue advanced and baseline grant monitoring activities including grant payment testing.
- Continue internal controls program activities to provide assurance that NSF controls for its payment processes are operating effectively.
- Continue collaboration with the OIG on risk reduction activities.
- Continue to improve improper payments risk assessment and reporting compliance activities.

MANAGEMENT CHALLENGE 4: Managing the Intergovernmental Personnel Act (IPA) Program

NSF Leads: Wonzie Gardner, Office Head, OIRM and Joanne Tornow, Assistant Director, BIO

Summary of OIG Identified Challenge

a) Because individuals serve in a temporary capacity for up to 4 years, there is frequent turnover in staff at NSF, especially in senior leadership positions filled by IPAs.
b) IPAs can spend up to 50 days each year on Independent Research/Development (IR/D).
c) IPAs are not subject to Federal pay and benefits limits.

NSF Management's Overview of the Challenge and Action Plan to Address and Monitor the Challenge

NSF's view of the residual risk considering key actions taken to achieve the objective of the challenge.

NSF provides the opportunity for scientists, engineers, and educators to rotate into the Foundation as temporary Program Directors, advisors, and leaders. Rotators bring fresh perspectives from across the country and across all fields of science and engineering supported by the Foundation, helping influence new directions for research in science, engineering, and education, including emerging interdisciplinary areas. Many of these rotators remain involved in their professional research and development activities while working at NSF through participation in the IR/D program, which is managed by the NSF IR/D Council.

NSF takes a proactive approach in the management of the IPA Program to appropriately consider and mitigate inherent risks associated with its execution.

Demonstrated Top Leadership Commitment:

The IPA Steering Committee reports directly to NSF Director France A. Córdova and Chief Operating Officer (COO) F. Fleming Crim and has been in place since April 2016. The IPA Steering Committee is comprised of senior-level leadership across the agency, namely a Chair and Vice-Chair who are part of the agency's Senior Executive Service (SES), the Chairs of the NSF Executive Resources Board (ERB) and IR/D Council, Head of the Office of Diversity and Inclusion, and four at-large members, including two SES and two executive-level IPAs.

The IPA Steering Committee is charged with ensuring NSF is best utilizing the IPA hiring authority. It advises the Foundation's senior leadership on matters that directly concern policy on the use of the IPA Program, and on common approaches to budgeting and implementation of the program. It also regularly reports on its oversight and stewardship of the IPA Program, including costs associated with the program, to the Director and COO, to OMB, and to Congress, pursuant to the AICA.

Capacity:

The IPA Steering Committee is supported in the execution of its responsibilities by various NSF units with key expertise for risk management, reporting, and accountability, including BFA, the OIRM's Division of Human Resource Management, the Office of General Counsel (OGC), the Office of Legislative and Public Affairs, and the Office of Integrative Activities.

Demonstrated Progress:

NSF is constantly improving its management of the IPA Program and addressing the management challenges identified by the OIG as well as other agency-identified risks and challenges. In this way, NSF is ensuring the program fully supports the mission of the agency and the nation's interests. Indeed, NSF believes that the steps taken to date as described above have reduced the inherent risk substantially, such that the residual risk is acceptable to the agency.

NSF's Corrective Measures to Address the Challenge

Demonstrated Progress Through Actions Taken in Prior Fiscal Years

a) Because individuals serve in a temporary capacity for up to 4 years, there is frequent turnover in staff at NSF, especially in senior leadership positions filled by IPAs.

- Ensured there is a "bench" of staff ready for developmental detail assignments to vacant executive positions through the Federal Executive Institute (FEI), American University Executive Leadership Program, Harvard Business School Leadership Training, Individual Development Plans, and NSF Academy Leadership Development Program.
- Implemented the New Executive Transition Program (NeXT) in 2009 to onboard employees and IPAs transitioning into executive-level positions to help new executives reach full performance as quickly as possible by developing executive knowledge about NSF mission, culture, organization, people, and business processes.
- Instituted mandatory and optional training for Program Officers, including IPAs, on NSF's Merit Review process which teaches how research proposals are evaluated and how to execute the Program Officer role.
- Created a parallel performance management system in 2014 for IPAs to ensure clarity in setting expectations and providing feedback on performance.

- Established a knowledge transfer process in 2015 that exiting executives can use to transfer knowledge and information to incoming executives.
- Implemented a required three-day supervisory training and development course in 2015 called Federal Supervision at NSF designed to assist new federal supervisors (including IPAs) in understanding their roles and all the requirements pertaining to federal human capital management.
- Established a Steering Committee for Policy and Oversight of the IPA Program (IPA Steering Committee) in April 2016 to serve as the primary body for considering policy on NSF's use of IPAs, and to oversee common approaches to budgeting and implementation of the IPA program.
- Conducted analysis (January 2018) on IPA years of service and found that, on average, IPA executives serve 3.1 years at NSF and are 3 times more likely to stay for 3-4 years compared to staff-level IPAs. Non-executives serve, on average, 2.3 years at NSF. Per OPM, the average time a career SES spends in a position is 3.4 years and non-career SES is 1.7 years.[1]
- Engaged with the GAO on an inquiry into the turnover of IPAs.

b) IPAs can spend up to 50 days each year on Independent Research/Development (IR/D).

- Established the IR/D Council in October 2011 to develop and monitor internal controls related to the IR/D Program, including tracking the time spent on IR/D activities. Data from these internal controls are disseminated to NSF senior management quarterly for use in managing the IR/D Program within each organization.
- Developed an IR/D Guide in 2012 to clearly communicate NSF policies on the use of IR/D, including the possibility that participation in the IR/D Program could be curtailed if it compromised the completion of NSF duties.
- Designated IR/D experts in each Directorate/Office who receive annual training to ensure that NSF policies are implemented appropriately.
- Instituted a requirement that all IR/D plans provide an explanation of how the IR/D activities enhance the requestor's ability to perform NSF duties.
- Published a revised IR/D Guide in January 2017 that includes guidance limiting NSF payment of IPAs' IR/D travel to their home institutions to 12 trips per year. The guidance encourages IPAs to combine other NSF official business and/or telework with these trips to more efficiently use of those travel dollars.
- Delivered a "Benefits of the NSF IR/D Program" report to the NSF Deputy Assistant Directors (DADs) in March 2018 highlighting the value of IR/D in recruitment, research currency, and ethics protection.

[1] *https://www.opm.gov/policy-data-oversight/senior-executive-service/facts-figures/#url=Demographics*

- Submitted the IR/D Annual Report to the DADs (November 2018), indicating that on average 75% of IPAs participated in IR/D, up from 72% in the prior year. On average, IPA IR/D plans requested 38 days of IR/D, yet only 19 days were used. As of October 2018, active IR/D plans for IPAs totaled $1.48M requested with an expected actual spend of approximately $750,000.

c) IPAs are not subject to Federal pay and benefits limits.

- NSF initiated a pilot requiring 10% cost sharing by IPAs' home institutions of their academic-year salaries and fringe benefits (per NSF Bulletin 16-11). This pilot applies to all new IPA agreements initiated in FY 2017 and beyond, including those for executive and program level staff. Additionally, NSF eliminated reimbursement for lost consulting.
- Received notice from the OIG in February 2017 closing the sole open audit recommendation related to IPA costs because of cost reduction efforts undertaken by NSF.
- Extended the cost-share pilot into FY 2018 to continue to evaluate the effectiveness of the 10% cost-share requirement. An evaluation of the effectiveness of the pilot launched in FY 2017 indicated a cost-share percentage increase from 7.2% in FY 2016 to 7.9% in FY 2017, which resulted in an average cost-share increase of almost $5,000 per IPA assignment.
- Engaged with the GAO on the salary reimbursements associated with IPAs. NSF does not set the salaries for rotators who are detailed to NSF using the IPA authority because their salaries are set by their home institutions.
- Submitted to Congress responses to the AICA (P.L. 114-329 Section 111 on Personnel Oversight regarding the Justifications for Rotator Pay Exceeding the SES Pay Max and Evaluation of the Cost-sharing Pilot (January 2018).

Demonstrated Progress Through Actions Taken in FY 2019

a) Because individuals serve in a temporary capacity for up to 4 years, there is frequent turnover in staff at NSF, especially in senior leadership positions filled by IPAs.

- Delivered the first IPA Program Annual Report to the Director of NSF. This report provides annual data and trend analyses on various aspects related to the use of IPAs at NSF for use by the Director and NSF senior managers in assessing and overseeing the program.
- Developed the CAP response to the GAO report, *A Workforce Strategy and Evaluation of Results Could Improve Use of Rotating Scientists, Engineers, and Educators* (GAO-18-533).

b) IPAs can spend up to 50 days each year on Independent Research/Development (IR/D).

- Monitored time spent on IR/D by both permanent and rotating staff, and provided quarterly data to NSF senior managers to ensure appropriate oversight of IR/D.
- Performed yearly data check to assure that no IPA IR/D participant travel was paid by NSF in excess of 12 trips per year.

c) IPAs are not subject to Federal pay and benefits limits.

- Extended the cost-share pilot into FY 2019 to continue to evaluate the effectiveness of the 10% cost-share requirement. A cost analysis of the IPA pilot launched for FY 2017 indicated a cost-share percentage increase from 7.2% in FY 2016 to 9.1% in FY 2018.
- Submitted to Congress annual responses to the AICA (P.L. 114-329 Section 111 on Personnel Oversight) on the Justifications for Rotator Pay Exceeding the SES Pay Max.

NSF's Anticipated Milestones

NSF management developed the anticipated milestones below in consideration of NSF's strategic and operational objectives, the risks inherent to achieving these objectives, and the key actions NSF has already taken in response to those risks.

a) Because individuals serve in a temporary capacity for up to 4 years, there is frequent turnover in staff at NSF, especially in senior leadership positions filled by IPAs.

- Submit the IPA Program Annual Report covering the prior fiscal year to the Director of NSF.
- Integrate activities associated with the CAP in response to GAO-18-533 into Renewing NSF goal 1 Adapting the Workforce to the Work.

b) IPAs can spend up to 50 days each year on Independent Research/Development (IR/D).

- Provide quarterly data to NSF senior managers to ensure appropriate oversight of IR/D time and travel by both permanent and rotating staff.
- Continue to perform yearly data check to assure that there are no IPA IR/D participants where NSF payment of travel to their home institutions exceeds 12 trips per year.

c) IPAs are not subject to Federal pay and benefits limits.

- Submit to Congress annual responses to the AICA on the Justifications for Rotator Pay Exceeding the SES Pay Max.

MANAGEMENT CHALLENGE 5: Managing the U.S. Antarctic Program (USAP)

NSF Lead: William Easterling, Assistant Director, Directorate for Geosciences and Kelly Falkner, Office Director, Polar Programs

Summary of OIG Identified Challenge

a) Fiscal oversight of the Antarctic Support Contractor (ASC) and its subcontractors.
b) Management of inventory.
c) Health and safety of research and contractors.
d) Modernization of facilities in the Antarctic Infrastructure Modernization for Science (AIMS) Project.

NSF Management's Overview of the Challenge and Action Plan to Address and Monitor the Challenge

NSF's view of the residual risk considering key actions taken to achieve the objective of the challenge.

NSF—through the Office of Polar Programs (OPP) in the Directorate for Geosciences (GEO)—funds and manages the U.S. Antarctic Program (USAP). The USAP supports United States' research and national policy goals in the Antarctic. The inherent risks associated with Antarctica's remote location, extreme environment, and the short period of time during which the continent is accessible has led to management challenges for NSF in the areas of: a) fiscal oversight of the ASC and its subcontractors; b) management of inventory; c) health and safety of researchers and contractors; and d) modernization of facilities in the AIMS project.

Through leadership commitments, dedication of staff and resources, corrective action planning, and monitoring implementation of plans, NSF has demonstrated significant progress in reducing the inherent risk to residual risk levels for USAP management that are well within acceptable ranges. The transition of the ASC responsibilities to Leidos has occurred without disruptions in operations or unwarranted increases in cost. Management controls and operating procedures are in place to monitor invoice processing, systems performance, indirect rates, and financial reporting for the USAP contractor. NSF performed root cause analyses of issues pertaining to the shipment and storage of property and inventory, and consequently developed and implemented process improvements. Routine NSF-led meetings are held with Leidos to emphasize prime contractor responsibilities to protect government property and inventory. All 2015 OIG misconduct-related action items, as expressed in the *Audit of Health and Safety in the U.S. Antarctic Program*, were closed by the OIG. NSF and USAP efforts continue to take positive steps to ensure USAP is well poised to address misconduct in the future through implementation of NSF processes for reporting and reviewing Code of Conduct violations. Additionally, NSF is closely monitoring Care Point's implementation of the selected pharmacy management software system. Planning and implementation of the modernization of McMurdo Station and other large facilities work in Antarctica are underway with cognizance by the National Science Board (NSB), OMB, and Congress. NSF successfully completed the AIMS Final Design Review (FDR) in Q1 of FY 2019, and the NSB authorized NSF to proceed with AIMS construction. NSF continues to engage the scientific community in efforts to minimize

disruption that the AIMS construction process might have on Antarctic science. NSF developed a 5-year long-range capital plan to include lifecycle and real property investments for all Antarctic locations and is working to extend that plan to a 10-year horizon.

NSF's Corrective Measures to Address the Challenge

Demonstrated Progress Through Actions Taken in Prior Fiscal Years

a) Fiscal oversight of the Antarctic Support Contractor (ASC) and its subcontractors.

- Held routine executive meetings with Lockheed Martin leadership to understand the strategic rationale for the transition to Leidos and the impact to the ASC.
- Began implementing the novation agreement processed by the Defense Contract Management Agency (DCMA) as the cognizant Federal Agency, which concluded that restructuring was in the best interest of the government.
- Monitored Leidos' operations on legacy Lockheed Martin systems. The Accounting System, Estimating System, Material Management and Accounting System, Purchasing System, and Property System were approved by DCMA in a letter dated August 25, 2016.
- Monitored the transfer of business systems from Lockheed Martin to Leidos. Subsequently, the Leidos DCMA Divisional Administrative Contracting Officer reviewed and approved Leidos' business systems.

b) Management of inventory.

- Conducted two detailed root cause analyses in response to early FY 2017 failures, followed by process improvements. NSF directed the ASC to develop reports on the damaged science equipment and mishandled science samples explaining how and why the damage occurred, and implement corrective actions to avoid such damage in the future. NSF then approved the action plans and monitored contractor activity for effectiveness.
- Modified contract policy so that going forward senior ASC management will be directly involved in all high value-science sample shipments to ensure minimum risk. Final approval for shipment must come from the senior transportation manager.
- Ensured that appropriate mitigation for the risk of loss or damage was implemented by November 2016.
- Directed NSF's annual assessment of ASC performance, which will identify cargo failures and contractor responses. Emphasis will be placed on opportunity costs of mishandled science samples and replacement costs of damaged inventory. Penalties will be considered in the contractor award fee.
- Continued to monitor cargo shipments during the August 2017 - February 2018 cycle.
- Conducted weekly NSF-led meetings with the prime contractor focused on protecting government property.

c) Health and safety of research and contractors.

- Code of Conduct:
  - Developed a process for reporting and reviewing Code of Conduct violations, which states that each year the OPP will send a request to all USAP employing organizations and NSF's on-site representatives (for grantees) for a report of all significant instances of on-ice misconduct for the previous 12 months. **This audit action item (#1) regarding the USAP Code of Conduct was formally closed by the OIG on March 28, 2017.**
  - Continued to implement NSF process for reporting and reviewing Code of Conduct violations.
  - Updated Code of Conduct to clarify to the community the consequences (e.g., potential removal) of misconduct in Antarctica.
- Law Enforcement:
  - Oversaw NSF's law enforcement program's achievement of full compliance with all U.S. Marshals Service requirements for certification and training, and recommendations for law enforcement tools made by the Service.
  - Initiated planning for a future site visit to Antarctica, resources and schedules permitting. OPP had internal conversations with OGC and reached out to law enforcement organization contacts.
  - Reviewed the final report dated March 12, 2018, of a group of law enforcement officials who had conducted an on-site evaluation in February 2018. The Law Enforcement review and site visit assessed equipment and training for special deputies and reviewed other areas, such as legal jurisdiction, USAP law enforcement staffing, facilities, communications with the U.S. Marshals Service, and detainment and transportation of suspects. The report contains recommendations and suggestions. **This audit action item (#3) regarding USAP Law Enforcement was formally closed by the OIG on June 12, 2018.**
- Breathalyzer Testing:
  - Procured breathalyzer units that do not require calibration. These units provide redundancy for the existing breathalyzer inventory. **This audit action sub-item (#4.2) regarding breathalyzer calibration was formally closed by the OIG on December 22, 2015.**
  - Continued to explore the advisability and feasibility of the OIG-recommended requirement for breathalyzer testing for all USAP participants.
  - Finalized a memo detailing the results of NSF exploration of the advisability and feasibility of implementing a requirement for breathalyzer testing for all USAP participants. NSF determined that since USAP supporting organizations have their own breathalyzer testing programs, the benefit of establishing and enforcing an NSF-managed breathalyzer program would not be worth the legal, contractual and financial obligations. NSF decided to accept the risk of not implementing its own breathalyzer program. **This audit action sub-item (#4.1) regarding the legality of requiring breathalyzer testing for all USAP participants was formally closed by the OIG on 02/05/2018.**

d) Modernization of facilities in the Antarctic Infrastructure Modernization for Science (AIMS) Project.

- Continued progress on the 2012 Blue Ribbon Panel (BRP) recommendations, including investment in life-cycle acquisitions and infrastructure upgrades.
- Addressed major infrastructure upgrades for McMurdo Station through the following design efforts:
  - Completed portions of designs for some of the AIMS project, including Core Facility and Utilities packages, and presented the designs to the MREFC Concept Design Review and Preliminary Design Review Panel.
  - Completed designs of the Vehicle Equipment/Operations Center using NSF Research and Related Activities funding.
  - Continued design on the Information Technology & Communications (IT&C) Primary Operations Center, Lodging Facility, and Palmer Pier Replacement projects.
  - Initiated construction of IT&C Primary Operations Center.
  - Completed presentation to the NSB, which resulted in the NSB's recommendation that the NSF Director or her designee include the AIMS project in a future budget request.
  - Completed ~ $2M in infrastructure investments in the Black Island Telecommunications Facility (BITF) to address BRP Recommendation 4.7-5, BITF risk management.
  - Issued a Sources Sought Notice on FBO.gov to apprise potential offerors on the AIMS project.
- Continued internal coordination with LFO to leverage institutional knowledge pertaining to previous large facilities work, including best practices and considerations outlined in NSF's *Large Facilities Manual* (NSF 17-066).
- Authorized additional design to advance the AIMS design beyond bridging documents (35%). Initiated and completed necessary initial solicitation efforts for individual AIMS components.
- Completed designs for and awarded IT&C Primary Addition for construction.
- Initiated acquisition of major components of the Ross Island Satellite communications Earth Station to address BITF deficiencies.
- Prepared for AIMS FDR, anticipated in Q1 of FY 2019.
- Continued to update the long-range capital plan to include lifecycle and real property investments for all Antarctic locations.

Demonstrated Progress Through Agency Actions Taken in FY 2019

a) Fiscal oversight of the Antarctic Support Contractor (ASC) and its subcontractors.

- Continued to monitor invoices, annual program plans, business system reviews (accounting, estimating, purchasing systems), indirect rates, and financial reporting for the USAP contractor to ensure strong cost controls continue with the new entity.
- Completed incurred costs audit of Lockheed Martin; NSF is waiting for DCAA to execute the audit for Leidos.

b) Management of inventory.

- Directed NSF's annual assessment of ASC performance, which will identify cargo failures and contractor responses. Emphasis will be placed on opportunity costs of mishandled science samples and replacement costs of damaged inventory. Penalties will be considered in the contractor award fee.
- Continued to monitor cargo shipments during the August 2018 - February 2019 cycle.
- Conducted weekly NSF-led meetings with the prime contractor focused on protecting government property.
- OIG site visit to Antarctica was completed in November 2018 and a visit to Denver was completed in June 2019. The site visits included auditing of USAP property management processes.

c) Health and safety of research and contractors.

- Code of Conduct:
  - Continued to implement NSF process for reporting and reviewing Code of Conduct violations.
- Law Enforcement:
  - Completed law enforcement site visit to South Pole Station in FY19 Q2.
- Pharmacy Management:
  - Continued to monitor Care Point's implementation of a selected pharmacy management software system.

d) Modernization of facilities in the Antarctic Infrastructure Modernization for Science (AIMS) Project.

- Began construction of IT&C Primary Addition.
- Completed successful AIMS FDR in Q1 of FY 2019.
- Continued to engage the scientific community in efforts to minimize disruption that the AIMS planning and construction process might have on Antarctic science.
- Updated the long-range 5-year capital plan (FY20-24) to include lifecycle and real property investments for all Antarctic locations.
  - NSB authorized NSF to make contract modifications to begin AIMS construction.

NSF's Anticipated Milestones

NSF management developed the anticipated milestones below in consideration of NSF's strategic and operational objectives, the risks inherent to achieving these objectives, and the key actions NSF has already taken in response to those risks.

a) Fiscal oversight of the Antarctic Support Contractor (ASC) and its subcontractors.

- Continue to apply invoice processing in accordance with the current NSF *Guidance and Instructions for Invoice Review and Processing* SOP.
- Engage DCAA for a cost incurred audit of Leidos for the FY18 ASC contract.

b) Management of inventory.

- Monitor cargo during the upcoming shipment cycle (August 2019 - February 2020).
- Continue to conduct weekly NSF-led meetings with the prime contractor focused on protecting government property.

c) Health and safety of research and contractors.

- Code of Conduct:
  - Continue to implement the process for reporting and reviewing Code of Conduct violations.
  - Continue to update the Code of Conduct as circumstances warrant.
- Law Enforcement:
  - Perform law enforcement site visit at Palmer Station in FY20 Q1.
- Pharmacy Management:
  - Continue to monitor Care Point's implementation of the selected pharmacy management software system.

d) Modernization of facilities in the Antarctic Infrastructure Modernization for Science (AIMS) Project.

- Continue AIMS project management, to include areas of procurement, logistics, planning, and design.
- Extend the long-range Antarctic capital plan for lifecycle and real property investments to a 10-year horizon (FY21-30).

MANAGEMENT CHALLENGE 6: Encouraging the Ethical Conduct of Research

NSF Lead: Fleming Crim, Chief Operating Officer

Summary of OIG Identified Challenge

a) Respond to broader definition of the Responsible Conduct of Research (RCR) which includes protecting the integrity of data; complying with relevant requirements; communicating openly with researchers, institutions, and funding agencies; mentoring; ensuring responsible authorship; managing conflicts of interests; and establishing research environments free of harassment.

b) Respond to encouragement to provide substantive guidance to the research community on mentoring and RCR training to accomplish the goals of the America COMPETES Act.

c) Foster the implementation of effective RCR training – including its content and how it is delivered – for all researchers, especially new members of the research community.

NSF Management's Overview of the Challenge and Action Plan to Address and Monitor the Challenge

NSF's view of the residual risk considering key actions taken to achieve the objective of the challenge.

The Responsible and Ethical Conduct of Research (RECR) is critical for excellence, as well as public trust, in science and engineering. NSF expressly defines this issue to be inclusive of both the responsible conduct and ethical conduct of research, recognizing a broad conceptualization of this topic. NSF does not tolerate research misconduct (RM) in proposing or performing research funded by NSF, in reviewing research proposals submitted to NSF, or in reporting research results funded by NSF. Allegations of RM are taken seriously and are investigated by NSF's OIG. The OIG refers completed investigations of RM to NSF for action. Upon determination of RM, NSF takes appropriate action against individuals or organizations.

Beyond NSF's RM role, NSF works to foster and maintain ethical research environments in which RECR is not only taught but practiced. RECR includes rigor and integrity, honest and objective peer review, protection of proprietary information and intellectual property, and treating students and colleagues with fairness and respect.

NSF leadership commits to RECR through increased programmatic investments, specifically the repositioned cross-directorate grants program, Ethical and Responsible Research, previously titled Cultivating Cultures for Ethical STEM; dedicated professional staff and senior executives in the Office of the Director and in the Research Directorates focused on ethics, research integrity, accountability, and research protection; and the oversight and stewardship of the revitalized Online Ethics Center at the National Academy of Engineering.

NSF's Corrective Measures to Address the Challenge

Demonstrated Progress Through Actions Taken in Prior Fiscal Years

- Issued Important Notice No. 140, Training in Responsible Conduct of Research – A Reminder of the NSF Requirement, from the NSF Director on August 17, 2017.
- Published revisions to Proposal and Award Policies and Procedures Guide (PAPPG) to point to promising practices in RECR training, including the encouragement of faculty training.
- Conducted outreach to principal investigator and awardee community on promising practices in RECR training, including involvement of STEM faculty in teaching and mentoring.
- Revised the Cultivating Cultures for Ethical STEM (CCE-STEM) Program Solicitation to incorporate research on promising practices in RECR training.
- Renewed and refreshed the mission of the Online Ethics Center to develop communities of promising practices in RECR education.
- Published and communicated widely NSF's new harassment policy.

Demonstrated Progress Through Agency Actions Taken in FY 2019

a) Respond to broader definition of the Responsible Conduct of Research (RCR) which includes protecting the integrity of data; complying with relevant requirements; communicating openly with researchers, institutions, and funding agencies; mentoring; ensuring responsible authorship; managing conflicts of interests; and establishing research environments free of harassment.

- Provided a comprehensive definition of RECR in the draft 2020 PAPPG: "The responsible and ethical conduct of research involves not only a responsibility to generate and disseminate knowledge with rigor and integrity, but also a responsibility to (a) conduct peer review with the highest ethical standards, (b) diligently protect proprietary information and intellectual property from inappropriate disclosure, and (c) treat students and colleagues fairly and with respect."
- Implemented NSF's harassment policy.
- Issued in draft 2020 PAPPG clarification of requirements for disclosure of institutional/professional appointments to achieve full transparency.
- Provided intramural and extramural guidance, resources, and consultation for the inclusion of ethics considerations in citizen science, collaborative/team science, and international science by NSF program officers overseeing the Ethics and Responsible Research Program.
- Issued Dear Colleague Letter encouraging researchers in computer and information science and engineering to include fairness, ethics, accountability, and transparency in their proposals.
- Provided Program Officer training on NSF harassment policy.

b) Respond to encouragement to provide substantive guidance to the research community on mentoring and RCR training to accomplish the goals of the America COMPETES Act.

- Provided guidance in the draft 2020 PAPPG on reference material to use in designing RECR training (NASEM Reports: Fostering Integrity in Research; Sexual Harassment of Women: Climate, Culture, and Consequences in Academic Sciences, Engineering, and Medicine; and Reproducibility and Replicability in Science).
- Provided guidance and encouragement in draft 2020 PAPPG on training faculty in RECR.
- Presented guidance and NSF perspectives to university research integrity officers and other research administrators at a workshop on RECR tools and methods for university leaders.
- Funded Online Ethics Center workshop on training STEM faculty new to teaching ethics using a "train the trainer" approach for capacity building across diverse STEM communities.
- Revised the solicitation for the Ethical and Responsible Research Program to also address topics such as the ethics of behavior at scientific field stations and the ethics of scientific reproducibility, as well as to enhance visibility across STEM fields funded by NSF.

c) Foster the implementation of effective RCR training – including its content and how it is delivered – for all researchers, especially new members of the research community.

- Continued to encourage the training of faculty in RECR.
- Continued to encourage STEM faculty to incorporate RECR into their mentoring, teaching, and curriculum development.
- Funded the Online Ethics Center to hold a workshop on identifying promising practices and innovative programs in RECR education and practice.
- Issued Dear Colleague Letter welcoming proposals in Education and Human Resources (EHR) on equity, inclusion, and ethics in STEM.

NSF's Anticipated Action Plan Milestones

NSF management developed the anticipated milestones below in consideration of NSF's strategic and operational objectives, the risks inherent to achieving these objectives, and the key actions NSF has already taken in response to those risks.

a) Respond to broader definition of the Responsible Conduct of Research (RCR) which includes protecting the integrity of data; complying with relevant requirements; communicating openly with researchers, institutions, and funding agencies; mentoring; ensuring responsible authorship; managing conflicts of interests; and establishing research environments free of harassment.

- Publish the final 2020 PAPPG.
- Develop further improvements for the 2021 PAPPG based on community feedback.
- Highlight changes to RECR provisions on 2020 PAPPG web page.
- Create RECR landing page that leads directly to NSF's encompassing RECR definition, policies, and programs.
- Increase the incorporation of ethics considerations into NSF research opportunities.

b) Respond to encouragement to provide substantive guidance to the research community on mentoring and RCR training to accomplish the goals of the America COMPETES Act.

- Continue to fund the Online Ethics Center and research on best practices.
- Hold promising practices workshops (including the Online Ethics Center workshop funded in FY 2019) and incorporate findings into guidance and outreach.
- Publish final 2020 PAPPG.
- Continue outreach on 2020 PAPPG.

c) Foster the implementation of effective RCR training – including its content and how it is delivered – for all researchers, especially new members of the research community.

- Continue to encourage and provide guidance for faculty to engage in RECR teaching and mentoring.
- Continue to work with academic institutions on promising practices for educating researchers at all levels.
- Fund projects in equity, inclusion, and ethics in STEM as a result of EHR Dear Colleague Letter.

National Science Foundation (NSF)
FY 2019 Progress Report on OIG Management Challenges

MANAGEMENT CHALLENGE 6: Mitigating Threats Posed by Foreign Government Talent Recruitment Programs (New for FY 2020)

NSF Lead: Rebecca Keiser, Office Head, Office of International Science and Engineering

Summary of OIG Identified Challenge

Last year, the OIG identified foreign talent plans as an emerging challenge area for FY 2019. This year, the OIG made mitigating threats from foreign government talent recruitment programs a standalone challenge for FY 2020. More specifically:

a) Foreign government talent recruitment programs designed to benefit the foreign state by obtaining information and technology from abroad have the potential to exploit the openness of American universities and threaten the integrity of U.S. research initiatives. Talent recruitment programs target individuals with expertise in cutting-edge science, including NSF-funded researchers, merit review panelists, and career Federal employees or rotators who manage NSF's scientific programs.

b) Failure to disclose membership in such programs can have ramifications.

c) There is risk of fraud, waste, or abuse of NSF or other Government assets.

NSF Management's Overview of the Challenge and Action Plan to Address and Monitor the Challenge

NSF's view of the residual risk considering key actions taken to achieve the objective of the challenge.

NSF is committed to sustaining Americas' innovation leadership, economic strength, and national security, including the basic research ecosystem that underpins it. The values of openness, transparency, merit-based competition, and reciprocal collaboration are essential to the functioning of that basic research ecosystem. The maintenance of a vibrant and diverse research community – including both domestic and international talent – is also essential. However, our science and engineering enterprise is put at risk when some foreign governments endeavor to benefit from the global research ecosystem without upholding these values. Certain foreign-government-sponsored talent recruitment

programs create new risks to the integrity of the ecosystem, including to NSF's mission and merit-review process. Faced with such a risk, NSF is responding.

The White House Office of Science and Technology Policy (OSTP) launched the Joint Committee on the Research Environment (JCORE) under the National Science and Technology Council on May 6, 2019, including a subcommittee on research security co-chaired by NSF. Under the leadership of OSTP, U.S. science funding agencies are committed to taking a risk-based approach to strike an appropriate balance between fostering the open and internationally collaborative environment that has contributed to the success of the U.S. research enterprise and mitigating emerging threats to the integrity of that enterprise. NSF also co-chairs a second JCORE subcommittee on coordinating administrative requirements for research across the science funding agencies, including those associated with research security. NSF is not the only agency or party involved in this important challenge, but we have a vital role to play. We work closely with other U.S. government science agencies to share policies and practices, and regularly engage with the academic research community to hear their concerns about this emerging challenge and clarify our positions, policies, and procedures.

NSF's Corrective Measures to Address the Challenge

Demonstrated Progress Through Agency Actions Taken in Prior Fiscal Years

NSF has long required those who submit proposals to NSF to disclose all professional appointments and sources of support, both foreign and domestic. These requirements have been outlined in the Proposal and Award Policies and Procedures Guide (PAPPG) for over five decades. For many years, the PAPPG has also provided NSF's policy on the responsible and ethical conduct of research (RCR), including requirements that institutions train undergraduates, graduate students, and postdoctoral researchers who will be supported by NSF to conduct research on RCR and provide oversight.

In April 2018, NSF issued a requirement that all staff employed by NSF or detailed to NSF must be U.S. citizens or have applied for U.S. citizenship. This requirement helps to ensure that NSF is applying consistent standards to all staff members, each of whom has access to sensitive merit review and other information.

Demonstrated Progress Through Agency Actions Taken in FY 2019

- Released a Dear Colleague Letter on Research Protection to the research community from Director Córdova.
- Co-chaired the White House's National Science and Technology Committee's JCORE subcommittee on research security; co-chaired the JCORE subcommittee on coordinating administrative requirements for research; engaged regularly with other U.S. agencies that fund basic research – including NIH, DOE, and USDA – and the State Department on science and security.

- Appointed top NSF leadership (i.e., the Head of the Office of International Science and Engineering) as the NSF lead on science and security; established a working group of Senior Executive Service-level leaders from relevant NSF Directorates and the Office of the Director; took a risk-based approach to protecting the basic research ecosystem.
- Increased capacity by hiring a new Program Manager who reports to the Head of the Office of International Science and Engineering with expertise in science and security as well as foreign talent programs.
- Issued a policy making it clear that NSF personnel and IPAs detailed to NSF cannot participate in foreign government talent recruitment programs; released a memo on research protection announcing the personnel policy to all NSF staff from Chief Operating Officer Crim.
- Issued a note to NSF staff reminding everyone that government ethics regulations require accurate and timely financial disclosure reports and that Federal ethics rules apply to both our career and rotator personnel.
- Analyzed the problem internally and with the assistance of external expertise; commissioned the independent scientific advisory group JASON to conduct a study on fundamental research and national security with the direction that it should include recommendations on ways for NSF and grantee institutions to achieve the best balance between scientific openness and security.
- Sought best practices through sessions with the National Science Board, the Advisory Committee on International Science and Engineering, and the Advisory Committee to the Directorate for Biological Sciences.
- Clarified requirements in the draft Proposal and Award Policies and Procedures Guide (PAPPG) regarding submission of information on:
    - Current and pending support
    - Professional appointments
    - Responsible and ethical conduct of research and the peer review process
- Communicated to the research community to increase awareness of the risks and compliance with the requirements; clarified PAPPG requirements and NSF's positions, policies, and procedures through presentations to multiple research community groups including the National Council of University Research Administrators, Council on Government Relations, Federal Demonstration Partnership, American Association of Universities, and National Academies of Science, Engineering and Medicine's Committee on Science, Engineering, Medicine, and Public Policy.
- Continue to communicate all of our actions and updates to our committees of jurisdiction in the House and Senate.

NSF's Anticipated Action Plan Milestones

NSF management developed the anticipated milestones below in consideration of NSF's strategic and operational objectives, the risks inherent to achieving these objectives, and the key actions NSF has already taken in response to those risks.

- Continue coordinating with the U.S. interagency including through supporting and complementing OSTP's actions, co-chairing the JCORE subcommittee on research security, and advancing work along the subcommittee's four lines of effort:

  - Coordinating outreach and engagement with federal agencies, academic research institutions, companies, non-governmental organizations, researchers, and students.
  - Establishing and coordinating disclosure requirements for participating in the federally-funded research enterprise.
  - Developing best practices for academic research institutions, in collaboration with academia, professional societies, and other organizations.
  - Developing methods for identification, assessment, and management of risk in the research enterprise.
- Release the final 2020 PAPPG, including clarifications regarding disclosure requirements, along with publishing in the Federal Register responses to public comments on the draft PAPPG.
- Streamline the process for providing disclosures to NSF by implementing electronic formats for submission of biographical sketches and current and pending support information.
- Anticipate receipt of independent third-party report from JASON related to fundamental research and national security; convene Senior Executive Service-level leaders from relevant NSF Directorates to evaluate the recommendations and, where appropriate, begin implementing; share the report publicly via the NSF website and encourage grantee institutions to consider its recommendations.
- Finalize a required training course for all NSF staff that defines the problem and why disclosure of all sources of support is vital to maintaining our robust research ecosystem and protecting taxpayer dollars.
- Continue and finalize actions taken in FY 2019.

FY 2019 PAYMENT INTEGRITY REPORTING

The Improper Payments Information Act of 2002 (IPIA; Pub. L. 107-300), as amended by the Improper Payments Elimination and Recovery Act of 2010 (IPERA; Pub. L. 111-204), and the Improper Payments Elimination and Recovery Improvement Act of 2012 (IPERIA; Pub. L. 112-248), require agencies to annually report information on improper payments to the President and Congress through their annual Performance Accountability Reports or AFRs. More detailed information on improper payments and all of the information previously reported in the AFR that is not included in the FY 2019 AFR can be found at https://paymentaccuracy.gov/.

I. Payment Reporting

Not applicable.

II. Recapture of Improper Payments Reporting

a. NSF's improper payments risk review and assessment activities have determined that there is not a significant risk of improper payments for the agency's grant program and support activities such as contracts, payments to employees, and credit cards. NSF is continuing its payment integrity risk mitigation activities by investing significant resources in its advanced and baseline grant monitoring programs, the Data Analytics and Assurance Program, and improper payments risk assessment and reporting compliance activities. These activities provide assurance to the agency that NSF has implemented robust control activities to mitigate the risk of improper payments.

b. Payment Recapture Audits Narrative

NSF did not conduct payment recapture audits during FY 2019. On September 30, 2015, OMB agreed with NSF's analysis that it would not be cost effective for the agency to conduct a recapture audit program.

c. Programs Excluded from the Payment Recapture Audit Program

OMB Circular A-123, Appendix C, Part III.C.6 provides guidance on "What should an agency do if it determines that a payment recapture audit program would not be cost effective?" In FY 2015, NSF determined that it would not be cost effective to conduct recapture audits of its single grants program and other activities (contracts, charge cards, and payments to employees). As noted in paragraph b above, NSF notified OMB and the NSF Inspector General of this decision and included supporting analysis. OMB agreed with NSF's determination.

NSF has leveraged the results of the work performed under IPERA, audits, grant monitoring programs, and internal control reviews. All consistently demonstrated that there is not a significant risk of unallowable costs/improper payments within NSF's single grant program and other activities. For FY 2019, NSF reviewed current year results from the similar data sources as used in the 2015 analysis in order to insure there were no significant changes that might make a payment recapture audit cost-effective.

d. Overpayments Recaptured Outside of Payment Recapture Audits

NSF collected remittances outside of payment recapture audits related to the following: payment reviews or audits, OIG reviews, Single Audit reports, and self-reported overpayments. These are reflected in Table 3.3 below.

Table 3.3 – Improper Payment Recaptures without Audit Programs

(Dollars in Millions)

Overpayments Recaptured outside of Payment Recapture Audits			
Program or Activity	**Amount Identified**	**Amount Recaptured**	**Percent Recaptured**
Grants	$11.820	$9.704	82.1%
Contracts	$0.762	$0.220	28.9%
Travel	$0.007	$0.007	100%
Purchase Cards	$0.000	$0.000	N/A
Payroll and Other	$0.449	$0.476	106%
TOTAL	**$13.038**	**$10.407**	**79.8%**

e. How Overpayments Recaptured through Payment Recapture Audits Were Used

Not applicable.

f. Aging Schedule of the Amount of Overpayments Identified through the Payment Recapture Audit Program that are Outstanding

Not applicable.

g. Overpayments Identified through Payment Recapture Audit Program Determined to Not Be Collectable

Not applicable.

III. Agency Improvement of Payment Accuracy with the Do Not Pay Initiative

NSF actively participates in OMB's Do Not Pay (DNP) initiative to reduce improper payments through the implementation of pre-award and post-payment activities. During the pre-award review process for all grants and cooperative agreements, the agency has incorporated DNP safeguards that complement NSF's existing policies and procedures for award management. NSF also has automated the reviews and centralized the pre-award verification. This has created efficiency gains by reducing the workload for manual verification.

NSF uses the Department of Treasury (Treasury) to disburse all funds. NSF payments are compliant with Treasury's Payment Application Modernization format and are screened against the following data sources: Social Security Death Master File (DMF) [public information] and the GSA System for Award Management (SAM) Exclusion Records [restricted information]. Any subsequent matches are viewable in Treasury's DNP online portal for adjudication purposes. No additional data sources are available in the Treasury payment integration process at this time. In FY 2019, 49,110 payments totaling $7 billion were screened through the Treasury DNP process (Table 3.4). NSF had no positive matches for DMF or SAM.

Implementation of the Treasury's Payment Application Modernization screening process has significantly reduced the number of false positives. This has produced resource savings for the agency from not having to manually research each false positive using the DNP online portal.

Table 3.4 – Results of the Do Not Pay Initiative in Preventing Improper Payments
(Dollars in Millions)

	Number of payments reviewed for possible improper payments	Dollars of payments reviewed for possible improper payments	Number of payments stopped	Dollars of payments stopped	Number of potential improper payments reviewed and determined accurate	Dollars of potential improper payments reviewed and determined accurate
Reviews with the Do Not Pay databases	49,110	$7,001.76	0	$0	0	$0
Reviews with databases not listed in IPERIA as Do Not Pay databases	N/A	N/A	N/A	N/A	N/A	N/A

IV. Barriers
Not applicable.

V. Accountability
Not applicable.

VI. Agency Information Systems and Other Infrastructure
Not applicable.

VII. Sampling and Estimation
Not applicable.

VIII. Risk Assessment
NSF conducted an improper payments risk assessment during FY 2018. The risk assessment determined that NSF did not have a significant risk of improper payments for its grants and cooperative agreements programs and administrative support functions for contracts, credit cards and payments to employees. NSF Audit Report No. 19-2-005, *Performance Audit over the Improper Payments Elimination and Recovery Act* noted that NSF complied with IPERA reporting requirements for FY 2018. During the third and fourth quarters of FY 2019 NSF conducted an improper payments risk review. The 2019 risk review found that NSF does not have a significant risk of improper payments. FY 2019 is the first year of the 3-year risk assessment cycle. NSF will conduct another risk review in FY 2020 and a risk assessment in FY 2021. The results of the risk reviews will be rolled forward to inform and supplement the risk assessment in the third year. The risk reviews identify trends or issues that may have to be further explored during the risk assessment. The primary difference between the risk reviews and risk assessment is the breadth of input from Subject Matter Experts throughout the agency.

The risk reviews and assessments take into account the OMB risk factors likely to contribute to improper payments. NSF enhances the OMB risk factors with additional considerations that are intended to further refine the risk factors relative to NSF payment activities.

The FY 2019 risk review covered disbursements for the grants and cooperative agreements programs and administrative support functions for contracts, credit cards and payments to employees through June 30, 2019. Disbursements for the fiscal year were reviewed after September 30, 2019 to validate that there were no significant changes during the period July 1 to September 30. The data source for the disbursement information was the general ledger of NSF's core financial management system, iTRAK. The disbursement data were reconciled to the gross outlays amount from the Statement of Budgetary Resources at June 30 and September 30 to provide assurance of coverage for the grants and cooperative agreements programs and administrative support functions.

FRAUD REDUCTION REPORT

The Fraud Reduction and Data Analytics Act (FRDAA) of 2015, P.L. 114-186, requires agencies to improve federal agency financial and administrative controls and procedures to assess and mitigate fraud risks, and to improve federal agencies' development and use of data analytics for the purpose of identifying, preventing, and responding to fraud, including improper payments.

NSF used the GAO Green Book and leading practices from the Fraud Risk Management Framework methodology as the basis for continuing to develop its fraud risk profile and the broader fraud risk management strategy. GAO's Fraud Risk Management Framework outlines how to develop a fraud risk profile and the necessity of prioritizing risks determined to be the highest priority in order to better achieve agency objectives. NSF took into consideration the potential for fraud when prioritizing the FRDAA implementation activities. This included considering the types of fraud that could occur, fraud risk factors, and the agency response to identified fraud.

In FY 2019, NSF continued its implementation of the FRDAA requirements by conducting a review of staff travel expenses with the goal to enhance monitoring using a data-centric approach. The review was conducted using four steps:

- Collected and analyzed information on staff travel expenses submitted through the travel voucher process.
- Reviewed (1) travel policies, (2) past travel voucher error cases, and (3) best practices in order to better understand the operating environment;
- Interviewed stakeholders to identify types of data relationships and sources throughout the travel process;
- Completed an exploratory data review to identify key data elements that aligned with potential errors; and
- Developed a data analytics model for possible future utilization to enhance travel monitoring activities.

The FY 2019 fraud risk activities underscore the viability of analytics to improve monitoring activities and insure effective operational controls. As NSF's data analytics program continues to mature, the assessment and development methodology implemented for the travel expense project will be used as a model for application in other NSF business areas such as grants and contracts.

In FY 2020, NSF plans to incorporate fraud risks into its analytics activities related to controls within the grants program. NSF will continue to identify fraud risks and identify data and information that can be leveraged to improve controls and monitoring activities.

UNDISBURSED BALANCES IN EXPIRED GRANT ACCOUNTS

In FY 2019, NSF funded research and education in science and engineering through grants and cooperative agreements to over 1,800 colleges, universities, and other institutions. NSF grants are funded in one of two ways: (1) the grant may be funded fully at the time of award, called a standard grant, or (2) the grant may be funded incrementally (one year at a time), called a continuing grant. In both cases, all costs on the grant must be incurred by the grantee during the term of the grant period. At NSF, grantees typically have 120 days after the grant expires to complete final drawdowns and expenditures.

The information provided here pertains to the agency's two grant making appropriation accounts: Research and Related Activities and Education and Human Resources. The data reported are based on the following definitions:

- An **expired grant** is a grant award that has reached the grant end date and is eligible for closeout. For NSF, this means grants with an expired period of performance.
- **Undisbursed balances** on expired grants are amounts that remain available for expenditure before it is closed out.

Once a grant has expired, NSF takes actions to close out the grant both administratively and financially. The financial closeout action takes place 120 days after the award expiration date when the undisbursed balances are de-obligated from the award. Administrative closeout is initiated after financial closeout is completed.

The methodology used to develop undisbursed balances on expired grant awards is consistent with the U.S. Government Accountability Office (GAO) conclusions documented in their April 2012 report, GAO-12-360, *Grants Management: Action Needed to Improve the Timeliness of Grant Closeouts by Federal Agencies,* along with discussion and clarifying information from GAO. The data reported here reflects the amount of undisbursed balances in grant accounts that have reached their end date and are eligible for closeout.

1. **In the preceding three fiscal years, provide the total number of expired grant accounts with undisbursed balances (on the first day for each fiscal year) for the department, agency, or instrumentality and the total amount that has not been obligated to specific grant or project remaining in the accounts.**
   The number of expired grants with undisbursed balances for the preceding three fiscal years is provided in Table 3.5. The numbers and balances reflect a point in time before expired awards are closed out during normal processes described above. For FY 2019, there were 5,204 expired grants with undisbursed balances of $97,666,016.

Table 3.5 – Status of Undisbursed Balances in Expired Grants

	FY 2019 (as of 9/30/19)	FY 2018 (as of 9/30/18)	FY 2017 (as of 9/30/17)
Number of expired grants	5,204	5,225	4,982
Undisbursed balances prior to closeout	$97,666,016	$107,860,158	$95,235,628

2. Details on future action the department, agency, or instrumentality will take to resolve undisbursed balances in expired grant accounts.

NSF continually monitors its grant awards throughout their lifecycle following a comprehensive post-award monitoring process. NSF grants are closed based on their period of performance end date. 120 days after the grant period has expired, all unliquidated (or undisbursed) award balances are de-obligated. Having small undisbursed balances at the end of the grant period is a routine occurrence, as not all grantees fully spend the funds obligated during the course of their research.

3. The method that the department, agency or instrumentality uses to track undisbursed balances in expired grant accounts.

NSF completes financial closeout of expired grant awards on a daily basis using a set of automated and manual activities. Eligibility for closeout for all NSF awards begins 120 days after the award expiration date. The NSF closeout process automatically de-obligates any unliquidated award balance, produces an award closeout transaction to flag the award as financially closed, and sends the financial closeout date to NSF's award management system. This initiates final administrative closeout procedures in the award management system.

The expected award closeout date is made available to awardees and staff through the Award Cash Management Service (ACM$). ACM$ requires the submission of award level payment amounts and expenditures each time funds are requested by awardees and allows NSF to complete post-award monitoring at the individual award level throughout the lifecycle of the award.

4. Process for identification of undisbursed balances in expired grant accounts that may be returned to the Treasury of the United States.

When a grant is closed out, the unliquidated balances are de-obligated. The de-obligated grant balances are treated one of three ways:

- If the source appropriation is still active, the balances are recovered by NSF and remain available for valid new obligations until the source appropriation's expiration date.
- If the source appropriation has expired but funds have not yet been canceled, the grant balances are recovered by NSF and remain available for upward adjustments on other existing obligations within the source appropriation.
- If the source appropriation has been canceled, the grant balances are returned to the Treasury.

Prior to September 30 of each year, all undisbursed grant balances in canceling appropriations are de-obligated and subsequently returned to Treasury.

REDUCE THE FOOTPRINT

NSF completed its headquarters relocation from Arlington to Alexandria, Virginia in early FY 2018. The new headquarters has state-of-the-art flexible workspaces, functionally-based office and workspace standards, virtual technologies, cloud computing, and alternative workplace arrangements that will allow the agency to increase staff but not its real estate footprint over the next 15 years. Of note, the new lease rates in Alexandria are lower than the lease rates in Arlington.

The square footage reported in Table 3.6, aligns with the data reported in the *Federal Real Property Profile* and the General Services Administration (GSA) *Occupancy Agreement (OA) Database* for FY 2018. This reporting shows an increase in the usable square footage (USF) from 597,354 USF to 608,478 USF. This is higher than the FY 2015 baseline primarily due to NSF's relocation. NSF's USF decreased by 278,425 USF in FY 2018. This reduction reflects the FY 2018 release of the Arlington buildings to GSA. NSF anticipates maintaining the total USF amount for the OAs with GSA from FY 2018 to FY 2032.

Table 3.6 - Reduce the Footprint Policy Baseline Comparison

Description	FY 2015 Baseline	FY 2018	Change (from FY 2015 Baseline to FY 2018)
NSF Occupancy Agreements (USF)	597,354	608,478	11,124

CIVIL MONETARY PENALTY ADJUSTMENT FOR INFLATION

The Federal Civil Penalties Inflation Adjustment Act Improvements Act of 2015 (the 2015 Act; Sec. 701 of Public Law [P.L.] 114–74) further amended the Federal Civil Penalties Inflation Adjustment Act of 1990 (P.L. 104–410) to improve the effectiveness of civil monetary penalties and to maintain their deterrent effect. The 2015 Act requires agencies to (1) adjust the level of civil monetary penalties with an initial "catch-up" adjustment through an interim final rulemaking and (2) make subsequent annual adjustments for inflation. Inflation adjustments are to be based on the percent change in the Consumer Price Index for all Urban Consumers (CPI-U) for the month of October preceding the date of the adjustment, relative to the October CPI-U in the year of the previous adjustment.

The only civil monetary penalties within NSF's jurisdiction are those authorized by the Antarctic Conservation Act of 1978, 16 U.S.C. 2401, et seq., and the Program Fraud Civil Remedies Act of 1986, 31 U.S.C. 3801, et seq.

The following table identifies NSF's FY 2019 inflation adjustments to civil monetary penalties.

Table 3.7 – FY 2019 Civil Monetary Penalty Adjustment for Inflation

Statutory Authority	Penalty (Name and Description)	Year Enacted	Latest Year of Adjustment (via Statute or Regulation)	Current Penalty Level ($ Amount or Range)	Location for Penalty Update Details
Antarctic Conservation Act of 1978, 16 U.S.C., 2401 *et seq.*, as amended	Antarctic Conservation Act, Knowing violations	1978	2019	$29,239	82 FR 65757 Thursday, December 21, 2018
Antarctic Conservation Act of 1978, 16 U.S.C., 2401 *et seq.*, as amended	Antarctic Conservation Act, Not knowing violations	1978	2019	$17,278	82 FR 65757 Thursday, December 21, 2018
Program Fraud Civil Remedies Act of 1986, 31 U.S.C., 3801, *et seq.*	Program Fraud violations	1986	2019	$11,463	82 FR 65757 Thursday, December 21, 2018

AWARDS TO AFFILIATED INSTITUTIONS

The following table lists institutions affiliated with members of the National Science Board (NSB) in FY 2019.[1]

Affiliated Institution	Awards Obligated in FY 2019 (Dollars in thousands)
Arizona State University	$68,781
California Institute of Technology	114,065
Georgetown University	9,061
Georgia Institute of Technology	87,047
Massachusetts Institute of Technology	96,516
Michigan State University	94,811
Purdue University	72,118
Southwest Research Institute	555
Stanford University	76,231
Tufts University	13,442
University of Colorado	104,142
University of Florida	57,540
University of Michigan	107,482
University of Oregon	14,434
University of the District of Columbia	5,444
University of Utah	36,863
University of Vermont	4,614
Washington University	20,065
TOTAL	***$ 983,211***

[1] This information is provided solely in the interest of openness and transparency. The table lists the dollar value of the awards made to institutions affiliated with NSB members during their time on the NSB in fiscal year ended September 30, 2019. NSB establishes the policies of NSF within the framework of applicable national policies set forth by the President and Congress. Federal conflict of interest rules prohibit NSB members from participating in matters where they have a conflict of interest or there is an impartiality concern without prior authorization from the designated agency Ethics Official. Individual NSF grant awards are made pursuant to a peer-review based process and most are not reviewed by the NSB. With regard to matters that are brought to the Board, NSB members are not involved in the review or approval of grant awards to their affiliated institutions. The table displaying Awards to Affiliated Institutions applicable to the previous fiscal year is available in the Appendices at https://www.nsf.gov/pubs/2019/nsf19002/pdf/nsf19002.pdf. Because of the regular turnover among NSB membership, the information in these tables is not directly comparable across years.

AWARDS TO ASSISTANT DIRECTOR IPAS' HOME INSTITUTIONS BY NSF DIRECTORATES

The following tables identify the awards made by directorates to the home institutions of Assistant Directors serving under the Intergovernmental Personnel Act (AD IPAs) during their time at NSF for the fiscal years ended September 30, 2019 and 2018. AD IPAs led five of the seven directorates during the fiscal year ended on September 30, 2019 and led six of the seven directorates during the fiscal year ended on September 30, 2018. NSF executive staff formulate directorate or office scientific goals, objectives, and priorities. Federal conflict of interest rules prohibit executives, including IPA detailees who serve in AD positions, from participating in matters where they have a conflict of interest or an impartiality concern. NSF grant awards are made pursuant to a merit-review based process and are not routinely reviewed by IPAs serving in executive positions. If matters are brought to such IPAs, they do not participate in the review or approval of awards to their home institutions. The following tables are provided in the interest of openness and transparency.

Table 3.8 – FY 2019 Awards to AD IPAs' Home Institutions
(Dollars in Thousands)

Directorate	Total Dollars and Awards Made by Directorate in FY 2019[1]	Home Institution of IPA Assistant Director	Total Dollars and Awards to Home Institution by Directorate in FY 2019	Total Dollars and Awards to Home Institution by NSF in FY 2019
Computer & Information Science & Engineering	$982,907 (3,411 awards)	University of Massachusetts – Amherst	$11,749 (54 awards)	$47,655 (197 awards)
Engineering	$970,592 (3,701 awards)	University of Michigan	$14,068 (52 awards)	$107,482 (299 awards)
Geosciences	$1,666,931 (2,549 awards)	The Pennsylvania State University	$13,147 (31 awards)	$77,300 (239 awards)
Mathematics & Physical Sciences	$1,556,611 (4,496 awards)	George Washington University	$634 (6 awards)	$11,373 (55 awards)
Social, Behavioral, & Economic Sciences	$239,443 (1,212 awards)	University of Michigan	$15,679 (32 awards)	$107,482 (299 awards)
Total	$5,416,484 (15,369 awards)		$55,277 (175 awards)	$243,810 [2] (790 awards)

[1] Some NSF awards are split funded, meaning an award is funded by two or more directorates. For a split-funded award in this column: the award is counted for each directorate; the award funding is only the split-funded amount.

[2] Two IPAs from the University of Michigan served as ADs during the entire FY 2019. Award dollars and count have been reduced by $107,482,000 and 299 awards, respectively, in this total box to avoid double counting.

Table 3.9 – FY 2018 Awards to AD IPAs' Home Institutions
(Dollars in Thousands)

Directorate	Total Dollars and Awards Made by Directorate in FY 2018	Home Institution of IPA Assistant Director	Total Dollars and Awards to Home Institution by Directorate in FY 2018	Total Dollars and Awards to Home Institution by NSF in FY 2018
Computer & Information Science & Engineering	$944,819 (3,427 awards)	University of Massachusetts Amherst	$7,667 (28 awards)	$30,331 (106 awards)
Engineering	$958,598 (3,624 awards)	University of Michigan	$16,328 (64 awards)	$102,140 (302 awards)
Geosciences	$1,494,531 (2,601 awards	The Pennsylvania State University	$10,929 (37 awards)	$75,783 (253 awards)
Mathematics & Physical Sciences	$1,580,787 (4,816 awards)	George Washington University	$2,599 (15 awards)	$20,086 (75 awards)
Social, Behavioral, & Economic Sciences[3]	$227,241 (1,252 awards)	Northwestern University	$2,194 (19 awards)	$43,221 (139 awards)
		University of Michigan	$6,779 (5 awards)	$17,535 (27 awards)
Biological Sciences	$762,918 (2,180 awards)	George Mason University	$0 (0 awards)	$100 (2 awards)
Total	$5,968,894 (17,900 awards)		$46,496 (168 awards)	$271,661 [4] (877 awards)

[3] This directorate was led by two AD IPAs during the fiscal year. To reflect this, home institution award data is shown for the portion of the year each IPA served as AD.

[4] Two IPAs from the University of Michigan served as ADs during FY 2018. Award dollars and count have been reduced by $17,535,000 and 27 awards, respectively, in this total box to avoid double counting.

PATENTS AND INVENTIONS RESULTING FROM NSF SUPPORT

The following information about inventions is being reported in compliance with Section 3(f) of the National Science Foundation Act of 1950, as amended [42 U.S.C. 1862(f)]. There were 1,473 NSF invention disclosures reported to NSF either directly or through the National Institutes of Health's iEdison database during FY 2019. Rights to these inventions were allocated in accordance with Chapter 18 of Title 35 of the United States Code, commonly called the "Bayh-Dole Act."

ACRONYMS

ACM$	NSF Award Cash Management Service
ACS	Account Code Structure
AFR	Agency Financial Report
AI	Artificial Intelligence
AICA	American Innovation and Competitiveness Act of 2017
AIMS	Antarctic Infrastructure Modernization for Science
AOAM	Agency Operations and Award Management
APG	Agency Priority Goal
APR	Annual Performance Report
ASC	Antarctic Support Contractor
BFA	Office of Budget, Finance and Award Management
BOAC	Business & Operations Advisory Committee
CA	Convergence Accelerator
CAP	Cross-Agency Priority
CFO	Chief Financial Officers
CFOC	Chief Financial Officers Council
COO	Chief Operating Officer
DAS	Division of Administrative Services
DATA Act	Digital Accountability and Transparency Act of 2014
DIS	Division of Information Systems
DNP	Do Not Pay (Initiative)
DOL	Department of Labor
DQP	Data Quality Plan
EHR	Directorate for Education and Human Resources (EHR)
EHT	Event Horizon Telescope
ERM	Enterprise Risk Management
FASAB	Federal Accounting Standards Advisory Board
FBWT	Fund Balance with Treasury
FECA	Federal Employees' Compensation Act
FFMIA	Federal Financial Management Improvement Act of 1996
FFRDC	Federally Funded Research and Development Center
FISMA	Federal Information Security Modernization Act
FMFIA	Federal Managers' Financial Integrity Act of 1982
FPPS	Federal Personnel/Payroll System
FTE	Full-time Equivalents
FY	Fiscal Year
GAAP	Generally Accepted Accounting Principles
GAO	Government Accountability Office
GEO	Directorate for Geosciences
GPRA	Government Performance and Results Modernization Act of 2010
GRFP	Graduate Research Fellowship Program
GSA	General Services Administration
H-1B	H-1B Nonimmigrant Petitioner Account
HRM	Division of Human Resource Management
IBC	Interior Business Center
IG	Inspector General
INCLUDES	Inclusion across the Nation of Communities of Learners of

	Underrepresented Discoverers in Engineering and Science
IPA	Intergovernmental Personnel Act
IPERA	Improper Payment Elimination and Recovery Act
IPERIA	Improper Payments Elimination and Recovery Improvement Act of 2012
IR/D	Independent Research/Development
IT	Information Technology
K-12	Kindergarten to Grade 12
LFO	Large Facilities Office
MFG	Major Facilities Guide
MOSAiC	Multidisciplinary drifting Observatory for the Study of Arctic Climate
MREFC	Major Research Equipment and Facilities Construction
NBAs	NSF Business Applications
NSB	National Science Board
NSF	National Science Foundation
O/D	Office of the Director
OIG	Office of Inspector General
OIRM	Office of Information and Resource Management
OMB	Office of Management and Budget
OPM	Office of Personnel Management
PAPPG	Proposal and Award Policies and Procedures Guide
PL	Public Law
PP&E	General Property, Plant, and Equipment
R&D	Research and Development
R&RA	Research and Related Activities
RECR	Responsible and Ethical Conduct of Research
RCR	Responsible Conduct of Research
RPA	Robotic Process Automation
RCRV	Regional Class Research Vessels
RSSI	Required Supplementary Stewardship Information
RV	research vessel
SAM	System for Award Management
SBR	Statement of Budgetary Resources
SES	Senior Executive Service
SFFAS	Statement of Federal Financial Accounting Standards
SOG	Standard Operating Guidance
SOP	Standard Operating Procedures
SSAE	Statement of Standards for Attestation Engagements
STEM	Science, Technology, Engineering, and Mathematics
USAP	U.S. Antarctic Program
USSGL	United States Standard General Ledger